

Disrupted place attachments and emotional energy geography in fracked Appalachia

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ARTICLE INFO

Keywords:

Appalachia

Pipelines

Embodiment

Energy geography

Place attachment

ABSTRACT

To date, there has been limited analysis at the intersection of extractive industry and emotional geography. Our research addresses this intersection by investigating how gas extraction, production, and distribution have disrupted residents' place attachment, and how this disruption is emotionally embodied. This research relies on 24 interviews and 2 workshops conducted in Ohio, Pennsylvania, and West Virginia in the summer of 2021. This tri-state region, sitting on the Marcellus shale, has witnessed a significant industrial buildout in the form of pipelines and hydraulic fracturing in the last fifteen years. This buildout is compounded by social vulnerability and environmental degradation resulting from the historical extractivism that has shaped Appalachia. From the results of this research, we argue that gas extraction, production, and distribution are not only a physical construction but also a system of unfairness and marginalization that materializes in emotional, embodied harms to residents. This paper illuminates the emotional dimensions of energy extractivism, advancing a synthesis of energy and emotional geographies which improves our understanding of how energy systems interact with lived experiences, an essential but overlooked aspect of energy extraction and production.

1. Introduction

Methane gas extraction, production, and distribution have proliferated in the United States as a result of new technologies that have made available previously inaccessible underground deposits. Following a boom of hydraulic fracturing in the mid-2000s, the Marcellus shale region has become an epicenter for petrochemical buildout, requiring the construction of chemical plants and pipelines as midstream infrastructure to move these materials from extraction sites to export centers (Ridder, 2018). Petrochemical production is predicted to account for approximately half of global gas consumption by 2050 (IEA, 2018).

Shale gas is the latest extractive economy in the Appalachian region as the coal industry continues to decline (Gruenspecht, 2019). For decades, the region has experienced socio-economic vulnerability and environmental deterioration as short-term economic growth, largely for companies outside of the region, has been prioritized over long-term concerns from resource extraction (Chalfant and Corrigan, 2019). This disparity leads some to describe Appalachia's landscape as a "sacrifice

zone" (Gaventa, 2021), which Henry (2019) defines as "[a landscape] considered expendable in pursuit of what government and industry stakeholders perceive as a 'greater good'" (p. 405). Social scientists have explored how the social and economic impacts of fracking have generated vulnerability, disempowerment, and displacement for affected communities (Perry, 2012; Ryder and Devine-Wright, 2022; Willow et al., 2014).

Gas infrastructures vastly alter landscapes, which can significantly impact communities and their emotions (Caretta et al., 2021). However, extractive infrastructures have historically been sited in rural, low-income communities that are underrepresented in energy justice research (Bosworth, 2019; Caretta and McHenry, 2020). Technical energy development research is overrepresented in knowledge production and application, and research that uplifts lived, embodied experiences with industry is less often valued and incorporated into policy discourse and decision-making (Carlson and Caretta, 2021). As Healy et al. (2019) state, the cost-benefit approach to energy impact assessments upholds a "narrow focus on biophysical impacts and an inherent blindness to

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<https://doi.org/10.1016/j.emospa.2025.101065>

Received 4 January 2024; Received in revised form 9 October 2024; Accepted 18 January 2025

Available online 31 January 2025

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social, cultural, and justice-related impacts, even when [those] impacts fall squarely within decision-makers' jurisdiction" (p. 229). To date, there has been limited research at the intersection of extractive industry and emotional geography. Our research explores this intersection by investigating how embodied emotions of gas extraction, production, and distribution have disrupted residents' place attachment. Our analysis is grounded in original material gathered in 2021 through 24 interviews and 2 body-mapping workshops.

In this article, we demonstrate the emotional and embodied impacts to residents from pipelines and associated gas infrastructures, countering the framing often presented by developers that pipelines are an "invisible" infrastructure (Barry and Gambino, 2020; Davies, 2022). We argue that gas extraction, production, and distribution are not only a physical construction but also a system of unfairness and marginalization that materializes in emotional, embodied harms to residents.

2. A place-based link: emotional energy geographies

The felt and emotive aspects of the extractive industry are significantly underexplored (Caretta et al., 2021; Ey et al., 2017). This research answers the call to synthesize energy and emotional geographies in pursuit of improving our understanding of how energy systems interact with lived experiences, an essential but overlooked aspect of energy extraction and production (Rohse et al., 2020).

Emotional geographers demonstrate the ways in which emotions are not simply bound in a subject but move and reflect how a subject exists in the world that already has affects and feelings structured in particular, patterned ways (Schmitz and Ahmed, 2014). Affect is the conceptualization of emotion outside of solely the personal by emphasizing the relationality between things as one body and or object acts on another. This concept disrupts the idea that emotions are generated within the body and then emanate out toward other human and non-human entities. Rather, affect illustrates how people are affected by and affect the people and things around them. Affectual capacities of human and non-human actors are unequal due to disparate power relations which heavily influence how emotions are constituted between two subjects (Tolia-Kelly, 2006). In addition to the co-production of emotions between actors, feelings are negotiated in relation to place itself through place-based attachment and place-based identity. Place-based attachment is defined as a person's or collective's love for or connection to their home environment, as well as the physical and emotional attachments to a particular place, and the meanings associated to a place over time (Relph, 1976; Scannell and Gifford, 2010; Willox et al., 2012). Place attachment influences place-based identity, meaning the formation of individual identities through a connection to place, the ways in which place provides meaning or purpose, and the ways in which identities are attached to and situated within place (Brown and Raymond, 2007).

When these attachments are threatened or disrupted, individuals may feel a loss of personal identity, cultural identity, and knowledge systems, resulting in feelings of "ecological grief" in which mental health deteriorates from place-based impacts (Cunsolo and Ellis, 2018, p. 276). Researchers in Appalachian contexts have demonstrated that extraction, including coal (e.g., Feng, 2020) and hydraulic fracturing (e.g., Sangamoorthy et al., 2016), disrupt attachments to place, identity, and community. This disruption is not only an emotional and mental change, but often also a physical sensation. This physical element is understood through the lens of embodiment.

Embodiment has been used in a variety of fields to understand how social injustices manifest through physical, bodily symptoms and suffering (Healy et al., 2019). Embodiment as an epistemological and methodological tool helps to explain the relationship between the landscape and the body as a linked geography by making explicit the physical, mental, and emotional connections between technological infrastructure, the landscape, and the self (Longhurst, 1995). Davidson and Milligan argue that the body is the "most immediate and intimately

felt geography" as the site of emotional experience and expression (2004, p. 523). Emotions therefore link the felt geographies of the mind and body with the broader social geographies of place. Moreover, a focus on embodied, situated knowledge is a deliberate choice to research the "private" or "personal," linking the home and body to broader geopolitics through the feminist understanding that the personal is political (Dyck, 2005; Haraway, 1988). Affect and embodied emotion are particularly relevant to research on energy geography and environmental (in)justice, systems which are imbued with geopolitical power and affectual capacity.

Energy geography is concerned with the ways that landscapes are shaped by energy extraction and production. Energy here is conceptualized not only as a physical resource but also as a social relation influencing spatial identities and connections to place (Calvert, 2016). This subfield within geography explores the ways in which livelihoods, material and discursive landscapes, territoriality, and cultures are intertwined with energy systems (Calvert, Greer and Maddison-MacFadyen, 2019). Landscapes are not just a point in space; rather, they reflect the history of environmental, cultural, and social interactions across space (Bridge et al., 2013). Moreover, cultural landscapes, although often in invisible ways, are the result of power struggles between different groups (Mitchell, 2003). Earlier research in energy geography has explored how energy alters societal relations, how energy systems affect everyday life, and the controversial and uneven ways that energy influences politics and development (Baka and Vaishnava, 2020; Bridge, 2018).

Studies of energy landscapes invoke the cultural and emotional attachments that people have to material aspects of a place. Geographers have focused on the different scales of these dynamics showing how, for instance, national political narratives about energy independence, access to resources, and nationalism enable local disposessions and environmental destruction (e.g. Perreault and Valdivia, 2010; Dahlmann et al., 2017). In the case of hydraulic fracturing, the spatial dimensions of these major energy infrastructures such as pipelines, which travel through space and cross borders, reify how local, regional, national, and global scales all converge and intertwine into a single process, resulting in many analytical dimensions regarding who is affected, who has agency to take action, and who bears responsibility (Bridge et al., 2013).

Energy extraction and production are weaponized to exert control over space and shift or maintain a balance of power, which has ethical and social implications that are unevenly spatially distributed, producing environmental and social injustices (Bridge and Gailing, 2020). In addition to displacement and dispossession, energy development can also lead to the "slow violence of landscape destruction, water contamination, and livelihood disruption" to both human and non-human populations (Huber, 2015, p. 4). "Slow violence," coined by Robert Nixon, defines the gradual and "attritional" violence that is drawn out across time and space and not necessarily recognized as violence (2011, p. 2). Davies (2022) uses this framing to study environmental injustices in the so-called "Cancer Alley" region of Louisiana, USA, to understand the material reality of residents impacted by the petrochemical industry. Studies of slow violence intersect with studies on environmental toxicity and the resulting emotional experiences of fear and worry (Navas et al., 2022). Slow violence can lead to feelings of entrapment and "stationary displacement" as residents are stuck in a place that has been stripped of its inhabitability and familiarity, without the desire or ability to leave (Davies, 2022, p. 8). This pressure to leave is a violence in and of itself.

Extractive operations can cause shifts in place attachments and threaten emotional links to places that residents want to protect, in addition to deeply altering the landscape itself (Bailey and Osborne, 2020; Pini et al., 2010; Caretta et al., 2021). Despite the framing of energy issues as primarily economic and technical, the emotional consequences of energy extraction play a central role in how people experience identity and place. Through a case study of gas extraction, production, and distribution in Appalachia, we reveal the emotions of

impacted communities as well as the “affects arising within and out of the energy system” (Rohse et al., 2020, p. 136), emphasizing the agency of the energy system in the production of space.

3. Methodology

We enter this work from multiple positionalities; Author 1 and Author 2 have studied pipelines in an academic context whereas Author 3 and Author 4 are activists living in fenceline communities experiencing the everyday impacts of energy landscapes. Following an institutional ethical approval process, qualitative data was gathered in 2021 and consists of 24 interviews across Ohio, West Virginia and Pennsylvania, four of which had two participants, for a total of 28 residents directly impacted by the gas buildout in the tri-state region. Due to COVID-19, twelve interviews were conducted face-to-face, nine were conducted over the phone, and three were conducted on Zoom or another video application. To explore emotional, embodied responses to changing energy landscapes, the interview questions revolved around the home, feelings, everyday experiences, and relationships.

While geographers have most often investigated emotions through interviews, we also employed *cuero-territorio* or body-mapping, a hands-on, participatory method that asks participants to draw or trace their body and then illustrate their emotions and experiences based on researcher prompts. Lorena Cabnal (2010), an Indigenous Maya Q'eqchi'-Xinka feminist activist, conceptualizes the body as a living and historical territory, and stresses that what happens on the land/territory is imprinted on our bodies through memories and embodied emotions. Because territories are often conquered in part through the violation of (Indigenous) women's bodies, particularly in the case of extractivist endeavors, Indigenous land struggles are thus intertwined with (women's) bodies (Cruz et al., 2017; Granovsky-Larsen, 2023). From this, we can conceptualize the scaled connections between the individual and personal with larger systems of geopolitical power (Cruz Hernández, 2016).

The method is carried out in a workshop setting that is structured around prompts given by the researcher, treating participants as experts and gathering both visual data and verbal discussion (for more method details see Zaragocin and Caretta, 2021). Two digital body mapping workshops were organized, lasting 2 h each and with a total of eight participants recruited both from interviewees for this study and previous studies conducted by Author 2. Participants were asked to draw an outline of their body on paper and respond to a series of questions. Participants then shared what they had drawn and discussed their illustrations together. Questions guided respondents to think about the relationship between gas infrastructures, the landscape, and their own bodies and emotions.

Research itself is an affectual space as researchers and participants exchange ideas and emotions (Nagar, 2014). Thus, both the participants and the researcher are impacted by the research process. When researching emotions, it is important to be especially intentional, responsive to participants, and aware of how the research positively or negatively impacts all parties (England, 1994). In interviews and workshops, we aimed to reciprocate vulnerability and empathy where possible, as well as to engage in conversation in ways that mitigated power dynamics associated with researcher-researched relationships. Moreover, several interviewees shared that they felt “lightened” or that it was good to get these stories “off their chest,” which is to say that these interviews, even around heavy subjects, can be positive experiences for participants through the creation of a caring interview space.

All interviews and *cuero-territorio* workshops were recorded and transcribed digitally, then coded in NVivo 12. Body-mapping participants also shared pictures of their maps and notes for hand coding. The data was validated using a twelve-question member-checking survey shared with participants via email (Baxter and Eyles, 1997). The questions used a Likert scale that asked participants to state how much they agreed with a variety of analytical results, and the responses to this

survey showed that 80–90% of participants agreed with each of the research conclusions. The integration of the member-checked data from interviewing and body-mapping yielded more complex and nuanced insights than the results of one method alone.

4. Disruptions to place attachment

In the results below we show that, before, during, and after construction, residents were experiencing elements of disruption to their self, home, and the surrounding landscape.

4.1. Self

Participants were impacted by gas extraction, production, and distribution through each of their five senses. In addition to seeing spills, explosions, and the invasion of industry, participants recalled fumes from compressor stations, leaking gas smells, and diesel truck exhaust. Sounds from industrial activity included traffic, compressor and pump stations, and noise during construction and operation. Interviewees often compared the sounds of pipeline blowdowns and wells to aircraft. Some reported a metal taste in their mouths. Others described being able to sense and feel the motion of construction and extraction as a vibration, even within their homes, comparing it to a train or jet engine. These sensory experiences were particularly emphasized during the body-mapping workshops (Fig. 1) as participants were asked to connect changes to the landscape to their embodied and emotional experiences.

Health concerns particularly demonstrated how participants felt a loss of power and political authority in protecting themselves, which shifted perceptions of their own agency. Half of participants reported that they had already experienced health effects from gas infrastructure, including burning eyes, nose, and throat; dry mouth and nosebleeds; congestion; headaches; shortness of breath; fatigue; nausea; sleeplessness; skin irritation; hair loss; endocrine disruption; and gastrointestinal issues. One participant shared that, when they contracted COVID-19, they would have to sleep with a washcloth over their face to try to keep compressor station chemicals from burning their lungs (Interview 11). Documented risks from pipelines include the release of radioactive and toxic chemicals like hydrogen sulfide and volatile organic compounds (Jianwen et al., 2014; Hendryx and Luo, 2020; Li et al., 2020). Participants feared that they had already been or would eventually be affected by these toxins, resulting in illness without being able to prove the cause.

Participants also reported psychological health effects including fear, anxiety, stress, anger, frustration, sadness, grief, and disappointment as a result of pipeline construction and operation. For some, the upheaval from this development left them with “uncontrollable” emotions that manifested both mentally and physically. Participants reported muscle pain, tension headaches, and physical and mental exhaustion. One participant shared that it was “too disturbing” to visit the parks near them because of the destruction from the pipelines and compressor stations and the fear of being “poisoned” (BM2 Participant 3). For some, this fear was not only a distant thought but a central factor in their lives, driving them to leave their homes temporarily or permanently, and distracting them from day-to-day activities.

A third of participants engaged in some form of documentation and data collection, including photography, recording daily experiences and symptoms, and communicating reports to company and government representatives. They effectively took on the role of environmental monitors and watchdogs, a new facet of their identity that they had not foreseen prior to the onset of gas extraction, production, and distribution. For all participants involved in this effort, their place-based identity was altered as they now viewed their homes and towns as sites to be monitored and recorded:

I always have to be on the lookout and concerned about a leak. The materials, ethane, butane, and propane, they're colorless, they're

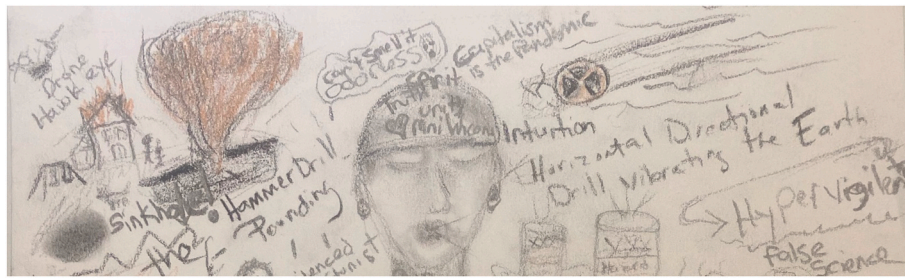


Fig. 1. Sensory Impacts Revealed through Body Mapping. Illustration with arrows pointing to the nose and mouth and text that reads “Benzene smell, [diesel] smell, metal taste, gasoline smell, pond smell, drilling, vibration, low pitch, hissing.”

odorless. But you may see fog, if conditions allow. In my backfield, I have four acres, and a lot of times we get fog. And I'll look and go, 'Oh my God, is that fog? Or is this a pipeline leak?' It's constantly looking for a leak or listening for changes in the environment. You always feel like you're on alert. (Interview 20)

This sense of being perpetually “on alert” is also reflected in the body-mapping illustrations (Fig. 2 and Fig. 3) below, in which an affected resident who was heavily involved in documentation described the intrusive fears they experience when they see an easement¹ or signs of construction. This drawing was in response to the question, “When you picture the pipelines, what images do you see?”

In addition to the physical changes in their environment, the way that residents were treated by companies and government authorities often disrupted their place-based identity and sense of belonging by causing residents to feel disrespected, unimportant, and “expendable” (Interview 12). This culminated in negative beliefs not only about these entities but about themselves and their worth to those in power. One resident shared anger that the FDA required Neutrogena® to pull sunscreen products from shelves because they had a trace of benzene, but it was deemed acceptable for residents to breathe in benzene emissions

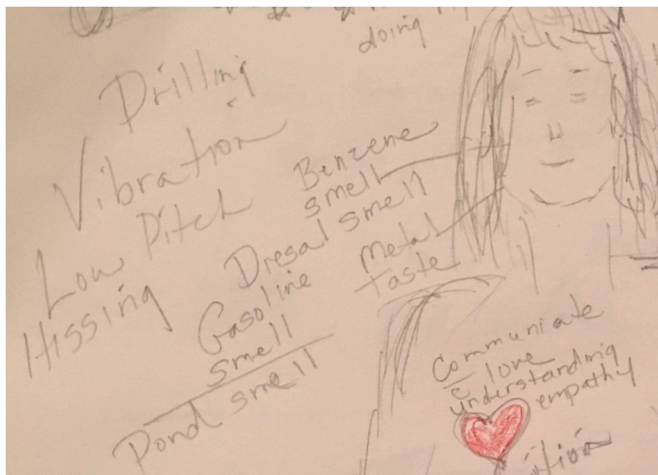


Fig. 2. Intrusive Images Revealed through Body Mapping. Illustration with a variety of images, including a depiction of a pipeline explosion next to a house with an adult and child running from the site, and a pipe with a radioactivity symbol.

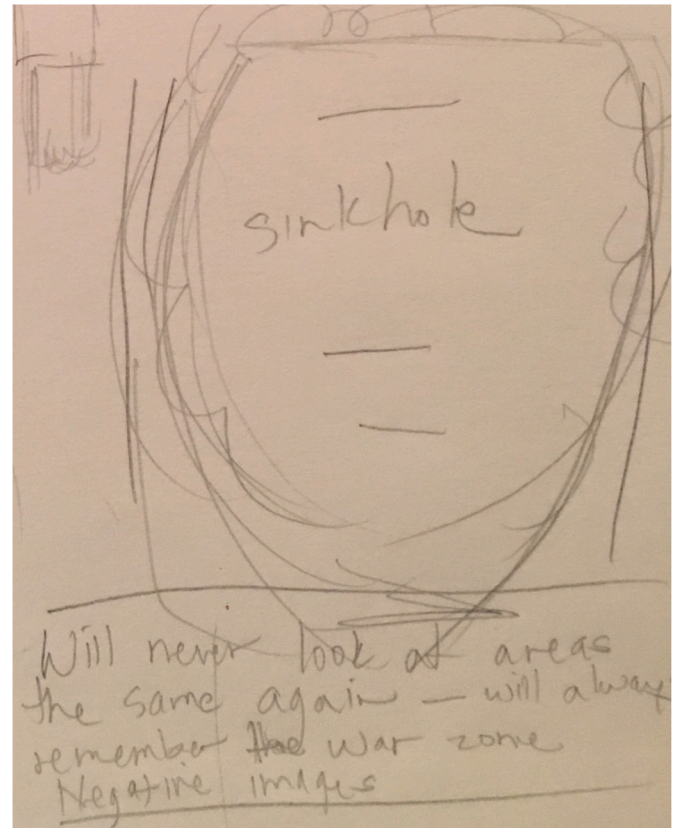


Fig. 3. Ruptured Attachment Revealed through Body Mapping. Illustration with a depiction of a sinkhole and text that reads, “Will never look at areas the same again - will always remember the war zone. Negative images.”

from a compressor station every day. This left them asking, “Why doesn't our life matter? Why doesn't our community matter? We're expendable” (Interview 12). This resident's story captures the anger of many participants at the living conditions they were burdened with as well as the attitude of government officials, who often dismissed their concerns. Participants in this study, similarly to other fenceline communities, found that their embodied knowledges of slow violence were challenged by a need for scientific “proof” (Ottinger, 2017), which leaves fenceline groups to confront a disconnect between their lived experiences and the resources through which to talk about them (Pohlhaus, 2012). This disconnect between emotional embodied knowledge and scientific proof contributes to a sense of place disruption and highlights the structural inequities and power imbalances of resource extraction (Malin et al., 2019).

¹ An easement is a property right that grants an individual or entity permission to use another person's property for a specific purpose. In the case of pipelines and associated midstream infrastructures, easements can be granted through eminent domain if a property owner refuses a voluntary agreement (Caretta and Carlson, 2023).

4.2. Home

Most participants had been in their houses for upwards of 20 years. They had invested time and money into renovations, cultivating farms and gardens, raising children and grandchildren, and developing a deep attachment. The disruption to place attachment due to gas extraction, production, and distribution was painful for many participants who felt a sense of grief around “mourning the loss of their home” (Interview 11). This is consistent with findings from other researchers that disruption to place can result in emotions of anxiety, loss, grief, and a feeling of displacement (Brown and Perkins, 1992; Devine-Wright, 2009).

All participants raised structural concerns about pipelines and other shale gas infrastructure; these concerns included sinkholes, slips, pipe deterioration, leaks, and explosions. One resident reported over 40 sinkholes in their town, including a school bus-sized sinkhole in a neighbor's yard (Interview 20). Another shared that their neighbor's home had been destroyed by a mudslide from a pipeline construction site, with workers waking them up in the middle of the night to evacuate (Interview 17). The longevity of these concerns is highlighted in the figure below from a body-mapping participant.

Many participants reported negative changes in day-to-day life from a range of disruptions for which they blamed industry. Some of these changes include constant traffic; light, noise, and air pollution; barriers to uses of their home; an inability to enjoy being outside in their yards and gardens; and hyper-vigilance in and around their homes. One person shared that they had not slept in their bedroom for ten years because of the noise and light from the pump station across the road (Interview 4). The culmination of these disruptions is felt in the loss shared by this participant:

I used to want to make a video. I come home at night and the fireflies are all going off, there's no noise. Take it to the market and say, this is where your organic vegetables are coming from. But you can't do that anymore, or feel like it's as perfect as it was. (Interview 1)

One resident described an incident after reporting well water contamination. Company representatives and Department of Environmental Protection officials were inspecting their property, and the following sentiments capture the feelings from many participants worried about contamination:

I probably had over 100 people, and as we're talking, we get thirsty. I offer them water from the tap. No, 'if you've got bottled water I'll take it,' but no one wants to touch this water. So regardless of what they print on paper, it's suspect because the final test is, 'have a glass.' All you gotta do is take eight ounces, and you would prove to me that this is fine. You don't need all these fancy tests. I know what happened to me from a sip, go ahead. (Interview 4)

Another participant was heavily affected by pollution from a compressor station, including loud blowoff releases of pressurized air from the pipes, and shared how their feelings towards their home had changed:

I hate it. I don't want to be here anymore. I used to love driving down the lane to come home, and now it's nothing but anxiety when you make that turn to come down. Is it going to be a good smelling day? Is it a bad smelling day? How many times [will the compressor station] blow off today? Am I gonna have to call to report today? Do I need to talk to [a regulator] today? Are the neighbors gonna call me today? I don't want to talk about it sometimes. And I feel bad because there's days all I can do is cry. (BM2 Participant 1)

This testimony shows the cumulative effects for residents from not only the industrial activity but also the changes to their social relationships, daily routines, and sense of safety.

All in all, a majority of participants reported that industry development negatively affected how they felt about their home. Some went as far as avoiding their homes due to the disruption, choosing to spend

more time in town or visiting friends. Others felt that their homes were tainted, as shared by this participant:

We've got a stocked bass pond up on the hill, there's pastures, there's caves. There's nut trees and wildlife. It's just a bit of magic. But it's almost like a shroud has been laid across it. (Interview 18)

In response to framings of the invisibility of slow violence and toxic pollution (Nixon, 2011), Davies directs us to ask an important question: “out of sight to whom?” (2022, p. 409). This slow violence is not invisible for the residents who are impacted by it, as evidenced by participants' lived experiences of the changes to their bodies, homes, and communities. These instances of slow violence rupture the attachment that residents feel to their homes.

4.3. Landscape

Participants were impacted not just by the infrastructure closest to their homes but also the presence of industry throughout the community, reflecting the concept of energy landscapes. They could see the industry's influence at their jobs, at doctors' offices and churches, when visiting friends and family, and throughout their days. A few participants described the inability to escape from the awareness of and proximity to gas industry:

Where I lived, we had a [horizontal directional] drill site 800 feet from me, and then I would drive to work in [the next town], close by. And I'd have an easement on the property at my job. And then I go shopping later, and I have an easement at the shopping center. So, it just seemed like, wherever I would go, it was following me. It's just embedded in our community, and you can't really escape it. (Interview 20)

The sense of being “followed” exemplifies the argument from affectual geography that space is composed of relations arising from networks and that people affect, and are affected by, the people and things around them (Schmitz and Ahmed, 2014). Specifically, these findings support an understanding of the emotional affectual capacities of energy infrastructures and networks in disrupting or altering place attachment. This capacity results in embodied emotions of fear, anger, and grief as residents expressed feelings of being on edge in their homes and communities, always on the lookout for a spill or worried for their future health.

Some participants shared particularly powerful stories of grief due to the development of these invasive landscapes. One shared they had a disabled daughter who lived a few towns over. During construction, the roads were too difficult to drive, and they were unable to visit. Their daughter passed two years into construction, and they shared:

I think about all those wasted days that we used to go for walks, and she used to bring my grandson out. She's gone, and he's gone because he had to move away. It affects your life in a whole bunch of ways, ways that you don't even expect it to hit you (Interview 18).

This story exemplifies the ways in which this industry can touch “every aspect” of a resident's life by transforming the landscapes that residents are bound by (Interview 12).

Several interviewees used imagery of war and invasion to describe their experiences, including viewing the pipelines as a “bomb” and seeing an “army occupation” from the onslaught of trucks, workers, and equipment. One resident described the well pads in their community as “the alien landing pad” (Interview 16). This imagery speaks to a broad network of intrusion that is expansive beyond the site of the home, in addition to unsettling the home as a symbol of security (Diener and Hagen, 2022). It was a very powerful disruption that left some participants with a completely altered sense of safety:

It's almost like going through a war, and you will always picture what happened during war time. So, when I see those areas, I will always think

of the pipes underneath, the bombs that are under us. That we're still at war, but now it's just not visible. (BM1 Participant 1)

This disconnection from the familiar landscape echoes findings from other research in the Marcellus region that the installation process and expansive magnitude of pipeline networks and other fracking infrastructure have transformed rural communities into contaminated industrial sites and invasive landscapes (Caretta et al., 2021; Meng, 2014). Many felt that there was no way to escape the “spaghetti” network of pipelines all over the region, “just one after another after another” (Interview 7). The experience shared by this interviewee captures the embodied disruptions to place attachment for many of the participants:

When my aunt and cousin would come and stay with my parents, both of them told me that, at three in the morning, something would wake them up. And it wasn't something you could hear. It was more something you could feel. It's not just a structural presence. You can feel it, you can smell it, you can see it. It's enormous. And it's overwhelming. (Interview 16)

Disruption to place attachment and place-based identity is not only an emotional reorientation but also a physical sensation. For most participants, the landscape and the self were linked through the emotional embodied responses to this changed geography.

5. Concluding discussion

Sovacool et al. (2017) argue that policymakers focus on technology and economics for energy solutions when in fact the problems are more deeply rooted in social, political, and cultural questions. Moreover, scholars such as Bell et al. (2020) have argued the importance of a feminist lens in analyzing the power imbued within energy systems and true solutions toward just energy economies. Following these authors, we emphasize the emotional, affectual capacity of the energy system in the production of space. We show how embodied emotions of gas extraction, production, and distribution have disrupted residents' place attachment in communities across Appalachia. Centering our analysis on emotional energy geographies, we make apparent the unequal power relations and affectual capacities between energy systems and impacted residents. By showing how landscape changes have affected people's sense of place, we also make visible the power struggles that are often invisible in cultural landscapes. This relational view challenges the understanding of energy as solely a technical or physical entity (Broto and Baker, 2018). More than a resource for extraction and production, for fenceline communities, energy is an affectual agent, and this research contributes empirical data about how gas extraction, production, and distribution, as with other forms of resource extraction, are “imbued with (and shaped by) emotions” (Sultana, 2011, p. 2).

Several studies have contributed to the emerging theorization of emotional energy geographies through explorations of mining and fracking (e.g., Bailey and Osborne, 2020; Perry, 2012; Rohse et al., 2020), yet very few studies have included an explicit focus on pipelines (Murrey, 2016; Graybill, 2013). This study's focus on pipelines extends the scope of emotional energy geographies beyond sites of extraction to the associated midstream infrastructures. We show that sites of gas transport, including pipelines, compressor stations, and metering and regulation stations, all have the capacity to disrupt place attachment and generate emotional upheaval. This expands our understanding of the spatial extent of the damage beyond the well pad to a distributed energy network. Notably, the use of the *cuerpo-territorio* allowed participants to articulate the embodied, relational, and emotional aspects of extractivism through a distinct focus on the body, feelings, and relations in a combination of drawing, journaling, and peer-to-peer sharing. Through this method, participants were able to make explicit the connections between the body, the self, and the landscape in ways that validated and strengthened the results from the interviews.

In information sessions, communities hear the oft-repeated phrase from pipeline company representatives that “you'll never know we were

here” (Author 3, personal communication, 2022). Developers present these projects as “invisible” economic opportunities that will be forgotten by the residents after the temporary disruption of construction (Barry and Gambino, 2020; Davies, 2022). These results demonstrate, however, that residents are faced with a disrupted or lost sense of place attachment before, during, and after the construction. Participants were dealing with the consequences of active construction sites and the influx of industry workers; they were anticipating potential future disasters like leaks, explosions, and rare illnesses; and they were coping with the aftermath of the disruption as they saw the “cuts” across their home and community landscapes.

This research and its focus on social, personal, emotional, and embodied impacts emphasizes the notion that extraction is not only physical removal and production processes but also social processes and power relations that heighten local vulnerability and maintain exploitative systems (Johnson et al., 2021). This research demonstrates the ways in which pipelines, compressor stations, well pads, and other midstream infrastructures, in addition to their material impacts, also become symbols of unfairness and marginalization for some participants who feel that they have been disregarded in the gas production process. This symbolism is captured by the comparison of the pipeline pathways to “bombs” as constant visual reminders not only of their physical presence, but also the social and emotional upheaval.

This study of fracked energy landscapes is an important contribution to the localized experiences of global fossil fuel production (Bridge, 2018). Technological zones are a physical representation of political and economic interests, and though energy production is a global phenomenon, its impacts and people's experiences with industry are highly localized and informed by their sense of place (Sangaramoorthy et al., 2016). In Ohio, West Virginia, and Pennsylvania, participants reported feeling powerless against the Goliath of energy corporations. The ways in which residents of this sacrifice zone, after centuries of being plundered by extractive industries, yet again feel that they were seen and treated as “expendable” (see e.g. Gaventa, 2021; Fisher and Smith, 2012) supports the argument that energy systems are physical representations of exclusion, marginalization, and uneven influence (Bridge, 2018). These fights are not only about the physical disruptions near the home, but also about broader dynamics of power and the lack of political authority for rural communities in protecting their own health and wellbeing.

With this piece we, on one hand, answer the call to engage, prioritize, and emphasize the emotional aspects of energy extraction (Rohse et al., 2020). Emotions have been regarded as apart from economics, but resource extraction practices, which have underpinned the global economy, are also social relations that are laced with power and sites of “immense contestation over value, identity, and place” (Ey et al., 2017, p. 2). Thus, conflicts over resources are “as much about property rights and entitlements as they are about embodied emotion, feeling, and lived experience related to the resource” (Sultana, 2011, p. 164). On the other hand, we make a call ourselves to strengthen the spatial analysis of energy geographies by focusing on how residents' emotions are reflected in space and place and vice versa. We argue that emotional energy geography can be a critical framework for investigating the political, social, cultural, and lived impacts of the shale gas energy system.

CRedit authorship contribution statement

Rachael Hood: Writing – original draft, Validation, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Martina Angela Caretta:** Writing – review & editing, Supervision, Resources, Methodology, Funding acquisition, Conceptualization. **Christina Digiulio:** Writing – review & editing, Writing – original draft. **Lora Snyder:** Writing – review & editing, Writing – original draft.

Declarations of competing interest

None.

Acknowledgements

We thank the participants of this research who lent their time and shared their knowledge with us. This research was made possible through funding awarded by the Heinz Foundation to Caretta. The Heinz foundation did not have involvement in the study design; collection, analysis and interpretation of data; writing of the report; or the decision to submit the article for publication.

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