Fracking: the choice between black gold and fundamental rights

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Abstract

This paper examines the practice of fracking in light of the connection between its problematic environmental consequences and its impact on human rights and social well-being. Fracking is a particular technique for the extraction of hydrocarbons which causes specific environmental costs, but also showcases the damaging effects of the fossil fuel industry more generally. It is practiced in different countries, but its usage is most intense in the United States. Therefore, two case studies are drawn from the US to explain how the interaction of environmental, social, political, and economic factors created by fracking results in significant human rights issues. The focus is placed on the rights to participatory decision-making (with an emphasis on choices concerning common resources), health, and equality. These are delineated with reference to the Universal Declaration of Human Rights, F.D. Roosevelt's Four Freedoms, and other milestones in the history of the international human rights framework. The paper ends with a reflection on the systematic nature of the problem of fracking, suggesting avenues for thought and action.

Keywords: fracking, fossil fuels, environment, human rights, system

There is a peculiar subtlety to the presence of fossil fuels in our lives. On the one hand, they are everywhere. They power our transportation, find multiple uses in our households, and are a vital component in most of the products we buy. The burning of fossil fuels is debated in public fora, and they are recognized as the key factor in the environmental degradation caused by Western production and consumption habits. Yet, we are able to distance ourselves from their ever-present role and their source. Some events, such as the Covid-19 pandemic, have brought our utter reliance on fossil fuels to the surface. When the world paused for the pandemic, suddenly suspending the flow of hydrocarbons fueling our consumerist lifestyles (Favole et al., 2020; Van Aken, 2020), we were reminded of our dependence on this energy source. Yet, epiphanies of this kind have been unable to open our eyes to the reality that fossil fuels are inherently, fundamentally dangerous; dangerous for the environment, but also for human rights, social equality, and fundamental well-being. The ambitious aim of this essay is to demonstrate this by focusing on a particular technique for fossil fuel recovery: hydraulic fracturing, or *fracking*.

Fracking provides a window to the threat of fossil fuels for several reasons. First of all, it is a form of unconventional oil and gas development (UOGD). Essentially, this means that it does not content itself with “ordinary” drilling of hydrocarbons, but intrudes further and further into the ground in the effort to take everything it has. In its aggressive reach, fracking is a metaphor for our insatiable hunger for fossil fuels. Fracking is also relevant because it has been employed for a remarkably long time compared to other unconventional methods. Its history clearly shows how the desire and invasive search for fossil fuels continue unabated, with little to no regard for human and environmental costs.

This paper will first explain the practice of fracking and identify the main geographical areas where its use has been particularly relevant. Subsequently, it will address the environmental impacts of fracking, collected under three distinct, but interconnected, domains: air, water, and land. Finally, this paper will address the relationship between fracking and human rights, described through three main categories of issues - commons, health, and equality - and through a comparative US-based case study. To conclude, this paper will engage in a reflection aiming to provide momentum for public discussion and action.

What is fracking?

Fracking, shorthand for “hydraulic fracturing”, is a method for recovering fluid hydrocarbons - oil and natural gas - from tight rock formations, which are characterized by a relatively high impermeability to fluids (Grotzinger & Jordan, 2014). This feature is determined by the low *porosity* of the rock (the percentage of its volume consisting of pores) and by the extent to which pores are interconnected. As oil and gas are accumulated in these spaces, the aim of fracking is to increase the volume and interconnectedness of pores; this allows for greater retrieval of hydrocarbons by providing more space for them to accumulate and migration channels through which they can more readily flow (Ding et al., 2012; Zhang et al., 2020). *Shale* formations are commonly fracked for gas due to their small pore size, which is generally in the order of nanometers (Chen et al., 2021).

As mentioned above, fracking belongs to the category of *unconventional* fossil fuel recovery; more specifically, it is a form of *secondary* recovery, which consists in the injection of a fluid to displace hydrocarbons that would be unreachable through conventional vertical drilling, or *primary* recovery. The procedure for fracking requires a deep well through which a highly pressurized fluid mixture can be injected into the rock formation. In most cases, once the well reaches the formation of interest it gradually turns to a horizontal perforated borehole extending through the rock layer. The whole conduit is cemented to avoid soil and groundwater contamination, as well as to increase its stability. From the perforations of the borehole, *fracking fluid* (or, in jargon, “frac fluid”) is powerfully pumped into the formation, creating small fissures through which the oil or gas trapped in the rock can be released, flow through the borehole and travel up the well (Fracking 101, 2019). The process of recovery (excluding the drilling) takes approximately 3 to 4 days.

The composition of fracking fluid can vary. Different types of fluids have been tested, such as foam-based fluids (Abdelaal et al., 2021). However, fracking is most commonly performed using water as a base component constituting 90% or more of the fluid. The remaining 10% includes several components. An essential one is the *propping agent,* a sand (silica sand is often employed) which keeps the fissures in the rock open to facilitate the flow. The propping agent accounts for about 8% of the composition of the fluid. Along with this sand, further constituents are chosen among a variety of chemicals, such as thickening agents, which allow for a better suspension and thus delivery of the propping sand, and acids, which help dissolve minerals and initiate fractures. Depending on the properties of the rock formation, different additives can be required for efficacy (Ferrer & Thurman, 2015).

Fracking fluid flows back to the surface with the hydrocarbons, from which it is separated and either disposed of by injection into underground facilities or reused (Grotzinger & Jordan, 2014). The chemical composition of the flowback is more uncertain than the initial one, however, as interactions between fluid and elements present in the rock reservoir can alter it (Harrison et al., 2017).

As stated earlier, fracking is among the oldest unconventional techniques for oil recovery. The roots of the idea date back to the mid-nineteenth century, when the concept of fracturing rock to induce the release of hydrocarbons was first tested by exploding torpedoes into oil-bearing rock strata. The first experimental application of rock fracturing using water took place in 1947 in Kansas, USA. The success of the experiment led to its first commercial uses in Oklahoma and Texas in 1949. Through time, the technique was improved and optimized through the development of more complex fracking fluids and the addition of propping sand. A key moment in the history of fracking was the first application of horizontal drilling in 1991, which allowed better exploitation of oil-filled shale strata and expansion of the search for fossil fuels to reservoirs lying beneath inhabited areas (Heinberg, 2013).

According to the U.S. Energy Information Administration (EIA), only four countries across the world produce commercially exploitable gas or oil through fracking: Canada, China, Argentina, and the United States. The US remains the leading producer (Maierean, 2021). However, the global map of fracking becomes much more complex if we consider its history and its prospects. In some countries, fracking was applied, but subsequently banned. France was the first country to impose such a ban in 2011, which was further enforced in a 2013 court ruling against a US oil company (BBC News, 2013). Other countries did not ban fracking completely, but imposed a moratorium, such as several European countries. Along with bans and moratoria, which are frequently owed to a higher level of attention to environmental and health risks than in North America (Maierean, 2021), Europe has imposed various obstacles to fracking. Several governments in Eastern Europe attempted to exploit national oil resources through fracking, often as part of an effort to gain independence from Russian oil. However, the commercial application of this practice was impeded by economic constraints, infrastructural factors, and - importantly - by public opposition (Maierean, 2021). The debate about hydraulic fracturing is currently resurfacing within some governments in response to the current energy crisis. The United Kingdom is a prime example, as rapid changes in the office of Prime Minister meant that a ban on fracking was first lifted and then reinstated within less than two months in 2022 (Morton, 2022).

Fracking remains a controversial practice. On one hand, debate was sparked by the proven environmental consequences of the practice; on the other hand, voices have been raised in response to the detrimental impacts fracking has had on people’s rights and freedoms in the areas surrounding oil and gas wells. Yet, fracking is still widely practiced. The following two sections aim at exploring its environmental and human rights effects.

Environmental impacts of fracking

"It's amazing that what took mother nature millions of years to build can be destroyed in a few hours by a piece of heavy machinery". (Cinema Management Group 2010)

The controversy on fracking can be better understood in light of the growing concern with the environmental damage caused by Western consumption and production habits. The numerous impacts of hydraulic fracturing directly affect the three great domains of air, water, and land, and through this they indirectly damage terrestrial life, including human communities. In scientific terms, fracking impacts all of the interrelated spheres of the Earth system: atmosphere, hydrosphere, lithosphere, and biosphere.

Perhaps the association between fracking and environmental damage that is easiest to notice is drawn through *air,* as the purpose of this unconventional drilling practice is the extraction of fossil fuels for *burning*. Fossil fuel burning is known to release great amounts of noxious gasses, particularly carbon dioxide (CO_2), but also methane (CH_4), carbon monoxide (CO), nitrogen oxide (NO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2) (Mittal & Kumar, 2014). CO_2 and CO are released in significant amounts and contribute greatly to the greenhouse effect, which is enhanced by CH_4 as well. Though emitted in lower quantities, NO_2, NO, and SO_2 contribute to the acidification of rain, smog formation and depletion of the ozone layer, as well as being toxic: inhalation can lead to several health issues, the most relevant category being lung and respiratory problems (Mittal & Kumar, 2014).

The emission of these pollutants is a broad problem associated with the extraction and consumption of fossil fuels in general. However, fracking entails a particularly high risk in relation to the release of methane (CH_4) in the atmosphere relative to other methods of fossil fuel recovery (Howarth et al., 2010; Alvarez et al., 2012; Haworth, 2019; Leahy, 2019). This is significant, as the global warming potential of methane is considerably higher than that of CO_2 (Alvarez et al., 2012; Howarth et al., 2010). In other words, even a small increase in the atmospheric concentration of CH_4 can have great effects on climate, especially on time scales of about 20 years, according to Alvarez et al. (2012). Studies based on carbon isotopes (the different molecular forms of the element) in the atmosphere suggest a correlation between the atmospheric CH_4 increase in recent years and the growth of the shale gas business pursued through fracking (Howarth, 2019; Leahy, 2019). Most of the methane release occurred during fracking operations has been interpreted as a result of leakage (International Energy Agency, n.d.); however, Howarth (2019) problematizes this rendering of facts by highlighting the conscious nature of several "leakage" channels, such as "purposeful venting [and] routine maintenance on pipelines and compressor stations [...], and the steadier but more subtle release of gas from storage tanks [...] and compressor stations to safely maintain pressures" (p. 3041).

However, the "sphere" of the Earth system which suffers the most from fracking is the hydrosphere. Water is an essential resource, but also a scarce one in many regions of the globe. According to the United Nations Environment Program (United Nations Environment Programme, 2022a), climate change and overconsumption are causing the aridification of important water reservoirs. Hydraulic fracturing is by definition based on water use; according to Mehany & Guggemos (2015), a fractured well consumes 6 million gallons (22712,5 m^3) of water on average. Therefore, fracking can promote drought and aridification, especially in areas that are already characterized by low water availability. To make matters worse, fracking relies on freshwater (Nicot & Scanlon, 2012); this can place a strain on communities living in the proximity of wells, as will be discussed in the next section.

Connected to water consumption, there are qualitative effects: the enrichment of massive volumes of water with sand and chemicals to produce fracking fluid means that an important amount of clean freshwater is withdrawn from the water cycle (Webb, 2017). Policy attempts at increased recycling of wastewater for use in other wells have been made (see, for instance, Rassenfoss, 2011), but they cannot solve problems of scarcity; additionally, they were rarely successful (Webb, 2017). The contamination of ground- and surface waters is a salient concern. According to Mehany & Guggemos (2015), water contamination can happen in several ways: leakage from faulty well cementing or improperly designed storage facilities for wastewater, potential connection of deep fractures with surface waters, or accidental blowouts. Furthermore, contamination can be owed to different reasons. One possibility is contamination with methane from the fossil fuel reservoir: a study conducted in the northeastern United States found CH_4 in drinking water wells near fracking sites (Mehany & Guggemos, 2015). Damage can also be attributed to the chemical composition of fracking fluid, which comes into direct contact with the rock reservoir. Fracking fluid has the potential to dissolve and incorporate elements present in the rock reservoir by dissolving rock minerals - indeed, some chemicals (often acidic ones) are included in the mixture precisely to this aim, as this facilitates the opening of additional paths for the flow of hydrocarbons (Ferrer & Thurman, 2015). Minerals might liberate toxic or radioactive elements, such as arsenic (As), lead (Pb), and uranium (U) (Harrison et al., 2017). These might then contaminate nearby freshwater, extending reservoir damage beyond the volume of the liquid used for hydraulic fracturing itself. The severity of damage varies depending on the geochemical features of each rock reservoir; this variability is the source of uncertainties and knowledge gaps in the composition of flowback fluids (Luek & Gonsior, 2017), which renders them ever so hazardous to the environment and to human health, as will be further discussed.

The conclusion of fracking operations entails the disposal of wastewater, unless the latter is recycled for further use. Disposal consists in injection into underground facilities (Brown, 2014). In addition to the risk of leakage from these facilities, the injection of wastewater into underground wells is correlated with enhanced seismicity in several areas, as the fluid can lubricate faults (the cracks in rock formations responsible for earthquakes) and therefore alleviate the friction that keeps them from sliding against each other, causing seismicity (Johnston et al., 2016; Frohlich, 2012). Shaking also increases the potential for groundwater contamination by favoring the release of further toxic compounds from the fractured rock formation (Dayal, 2017).

To conclude, the impacts of fracking on air, water, and land are multifarious and dangerous. The risk they represent does not only concern the environment, but also the communities who are part and parcel of it. This bridges the discussion to the next section, which assesses the many impacts that fracking has on people, their rights, and their freedom.

Fracking and human rights

If the complex interrelations between the environmental and human rights impacts of fracking could be collected in a single image, it would be the image of burning water.

Burning water from a tap: a new normal owed to fracking?

It sounds like an oxymoron. Yet, director Josh Fox captured this phenomenon on camera in 2010, when he produced the documentary film *Gasland*, a denunciative narration of the human impacts of fracking. The key to understanding the ignition is the presence of dissolved methane in the water, which has been shown to be especially high near fracking sites (Osborn et al., 2011). More precisely, the flame is owed to methane escaping the water when it comes into contact with the surrounding air. Along with being of scientific interest, the image is a fitting visual representation of the dangers that fracking represents for human communities. The effects of fracking on air, water, and land can be connected to a wide array of social issues, which directly relate to human rights. Throughout this section, these issues will be discussed. It is important to note that this review is in no way complete: an all-inclusive account would require books to cover. Therefore, the purpose of this section is to raise attention to the most relevant and encompassing social issues, collected under the headings of the commons, health, and equality.

Commons

The definition of "commons" entails two fundamental, interrelated meanings. On one hand, the commons can be intended as the resources that are held in common by all members of a community or society. On the other hand, they can be defined as a social practice of shared oversight and enjoyment of resources contrasting private ownership. This concept has entered the dialogue on natural resources and enlivened it with a powerful force. Essential living resources such as air, water, and land are regarded by many as a common right of humankind as a whole. However, the real-world picture of resource use is not very rosy, as we find ourselves asking: *who owns* these resources?

In 1968, Garrett Hardin coined the concept of the "tragedy of the commons", which referred to the imminent condition of an overpopulated Earth unable to provide all its inhabitants with essential resources. Today, we could rephrase this concept by firmly acknowledging that the “tragedy of the commons” is that there seem to be *no* commons. Although the concept of ownership itself defies their nature of *commonality,* these resources are frequently subject to regimes of proprietorship that often form alliances with dominant ideologies. Political nuances must be considered to understand the variability of regulatory arrangements establishing *who* has the right to use alleged commons. A comparison of two case studies from the United States - Pennsylvania and Texas - exemplifies this. Although the US as a whole is historically based on the value of capitalist private ownership and property rights, this does not imply a convergence of fracking regulations among all 50 states. Warner & Shapiro (2013) define the regulatory panorama of the US as a story of “fragmented federalism” (p. 474), as differentiated modes of management fracture nationwide governance of the shale oil sector and give rise to differences in the access to resources and rights. The cases of Pennsylvania and Texas highlight how an environmental issue is intrinsically also a political and economic one in a regime where the commons are *owned*, and how this intersection of environment, politics, and economic interest readily translates into a significant human rights concern.

Pennsylvania and Texas share the condition of being among the greatest producers in the United States oil industry, thanks to the presence of great shale formations suited for hydraulic fracturing. In spite of this, approaches to both the regulation and the consequences of fracking are very different due to political, judicial, and historical factors. The fracking industry in Pennsylvania heavily relies on the extensive Marcellus Shale, which was first drilled in 2003, and has established unconventional oil extraction as a core economic sector in the state (Brasier et al., 2011). While the status of fracking in Pennsylvania is by no means unproblematic (PA Office of Attorney General, 2020), the state has given some weight to environmental concerns, as well as residents’ voices. These two factors were taken into account in judicial rulings and recommendations (Davis, 2017; PA Office of Attorney

General, 2020). The situation is different in Texas, which is also home to important rock formations, such as the Barnett Shale, where horizontal drilling was first experimented with in the 1980s (Heinberg, 2013). Here, attempts to escape fracking regulation have consistently taken place. In 2015, the State Governor signed the "Denton Fracking Bill" prohibiting cities from adopting fracking bans in response to the city of Denton's attempt to forbid fracking locally due to its detrimental effects (Malewitz, 2015). The long history of fracking in Texas surely plays a role in regional management of the sector, as demonstrated by the fact that Texas was among the states citing such history of "successfully regulated" shale exploration as a response to attempts to impose broader federal regulation (Warner & Shapiro, 2013).

If the judicial action taken in Pennsylvania gives some hope for the interaction between people and institutions, the exercise of regulatory power in Texas can be classified as explicit neglect of people's voices. Unequivocal opposition to fracking, clearly demonstrated by attempts to prevent it from happening near Denton and several other cities, was met with an undemocratic reaction that constitutes a threat to human rights. Democratic principles, especially the right to participation in government, are enshrined in Article 21 of the Universal Declaration of Human Rights, which states that "Everyone has the right to take part in the government of his country, directly or through freely chosen representatives" (United Nations, n.d.). Nested within this formulation is the right to participation in decision-making, which embraces choices regarding resources meant for common use.

In light of the right to democracy and participation, the Texas governor's decision to deny people the ability to raise their voice against fracking is not compatible with human rights, nor with the more recent United Nations Sustainable Development Goals (SDGs), a set of objectives aiming at the achievement of sustainability from a human and social perspective along with an environmental one (The 17 Goals, n.d.). Indeed, SDG 16 (*Peace, Justice and Strong Institutions*) emphasizes justice and democratic institutions.

The governor's ordinance does not only deprive people of the right to participate in decisions that affect their lives; its consequences on air, water, and land impact further rights and freedoms, some of which are also components of the SDG framework. Consequences are most evident when considering water. The high amount of water used for fracturing operations is taken away from communities, causing shortage of an essential resource. This issue can be filtered through the perspective of the four fundamental freedoms declared by Franklin D. Roosevelt in 1941 (FDRLibrary, 2016) and classified as a threat to, if not an outright violation of, *freedom from want*, as the failure to fulfill the basic need for water can create new situations of deficit that threaten people's lives and livelihoods. Even when the water does reach the inhabitants of the surrounding area, it can bring toxic contaminants along, which threaten the enjoyment of *Clean Water and Sanitation for all,* a right declared in SDG 6 (The 17 Goals, n.d).

The subjection to unjust political institutions is accompanied by powerlessness against the oil corporations, which are, unsurprisingly, often enmeshed in politics (Hudgins & Poole, 2014). US legislation does not provide help against the power of private ownership, as it states that the owner of a land asset acquires the mineral rights of the land itself. This means that the soil, rock, and associated resources lying beneath a shale oil company's property are considered just as private as the surface by the law (Maierean, 2021). This assertion is intrinsically contradictory. Don't the horizontal boreholes reach under cities, public parks, and homes in their grasp for oil through the rock? Indeed, sometimes processing facilities for fossil fuels are located just across the street from a school (Baddour, 2023). The air polluted by the burning of fossil fuels, as well as by emissions associated with their extraction, does not care for trespassing private property lines; it enters the bodies of all who breathe it. The water flowing within the confines of land acquired by shale oil corporations, contaminated with dangerous chemicals, knows no such confines, nor those of the wells and the pipes that lead to people's homes over wide areas. When the land shakes because of pressurized injections, it shakes for all that share it.

Josh Fox's documentary *Gasland* (2010), mentioned at the beginning of this section, exemplifies the problematic nature of corporations' private ownership of land. Fox got the inspiration for the documentary when he received a $100,000 offer by a private oil company in exchange for his land. Fox refused the money and set out on a journey through the United States instead, with the aim of uncovering the darkest sides of the fracking industry (Cinema Management Group, 2011). The trailer of the documentary features a woman, among others, who summarizes the powerlessness and frustration of those who live near fracking wells in one sentence: "They can drill whether we like it or not" (Cinema Management Group, 2010). Fox's crude and provocative portrayal of the fracking industry does not omit the risks to people's health, which are the focus of the next section.

Health

The importance of health has been underlined ever since the emergence of the international human rights framework. Article 25 of the Universal Declaration of Human Rights (1948) enshrines the right to health and relates it to the right to *security* in a wider sense. More precisely, every individual must be "secure" upon encountering difficulties owed to "circumstances beyond his control" (United Nations, n.d.) that can affect one's health and well-being. A specific focus is placed on motherhood and childhood, which must be regarded with appropriate care. Although it feels appropriate to point out the use of gendered language - which is problematic - this is not the point of this discussion; what is relevant here is the attention placed early on upon health. The International Covenant on Economic, Social and Cultural Rights (1966) raises the standard even higher by asserting the right of everyone to attain the highest possible level of physical and mental health in Article 12. Further, the United Nations (UN) made *Good health and well-being* the focus of SDG 3 in 2015. The most recent development in light of the growing importance of environmental concerns is owed to the UN General Assembly's drawing of a crystal-clear connection between health and the environment in its declaration of the right to a *clean, healthy and sustainable environment* (United Nations Environment Programme, 2022b).

In spite of the international recognition of the right to health and well-being and the high number of countries recognizing the abovementioned documents as valid, practices that pose a threat to human health and well-being still exist. Fracking is one of these. The most researched connection between the environmental impacts of fracking and human health is the danger represented by gas emissions. Research has focused significantly on evaluating the difference in exposure to harmful chemical compounds between people residing within a short distance from a fracking site and communities further away, or between people living upwind and downwind of a site (Li et al., 2022). People living nearby or downwind of wells are statistically more exposed to health hazards, including a heightened presence of known carcinogenic substances (Garcia-Gonzales et al., 2019). Additional research suggests a correlation between the proximity to unconventional oil wells and symptoms such as fatigue and migraine (Tustin et al., 2016). Predictably, the category of oil well workers is more exposed to inhaling substances known to be correlated with lung and respiratory diseases, such as the silica sand used in the drilling process, which are often found in excessive concentrations around boreholes (Snawder et al., 2014; Moitra et al., 2015). Therefore, the heightened chance of worker fatalities adds to the concerns interrogating the ethical nature of unconventional oil recovery.

As explained above, water is also among the essential resources damaged by fracking (Adgate et al., 2014). Images of dark, sludgy water from *Gasland* provide convincing enough proof of the contamination; if that was not sufficient, the problem is confirmed by studies that found excessive amounts of chromium, mercury, and other dangerous compounds in water near fracking operations (Johnston et al., 2016). Although empirical analyses have been possible, research on this particular facet presents more obstacles than that conducted on air quality. While the air pollutants deriving from the fossil fuel industry in general are relatively known, water contamination is surrounded by uncertainties that are political and economic before being chemical and medical. In relation to our American case studies, Pennsylvania and Texas, let us look at the US legislative framework. The most important law on water quality in the US is the Safe Drinking Water Act (SDWA), first passed by Congress in 1974. Although the SDWA confronts underground injection of fluids, a not-so-hidden loophole exempts fracking water from its legislative - therefore also judicial - reach, unless the fluid mixture contains diesel fuel (Warner & Shapiro, 2013). The contradiction is evident, as many chemicals commonly used in fracking are individually deemed as hazardous by the SDWA (Ferrer & Thurman, 2015). One could claim that the right to a just law is drowning in polluted waters along with the right to health.

A final consideration can be made regarding mental health, a side of well-being that often goes unnoticed. Proximity to hydraulic fracturing can cause considerable psychological stress (Adgate et al., 2014). In a wider perspective, this stress can be, or become, a manifestation of so-called *eco-anxiety*, an unease caused by the feelings of fear, anger, or despair owed to the ecological and climate crises. An important feature of eco-anxiety is its effect on the capacity to imagine one's future (Coffey et al., 2021), which can lead to a depressive vicious cycle and an overall lack of well-being. Eco-anxiety is a present-day challenge to Roosevelt's *freedom from fear.* Roosevelt's image of fear was spawned by the atrocities of war; ours is rooted in images of impending environmental catastrophe and of its consequences. In the case of fracking, these are not only the threat to democracy, the appropriation of the commons, and the damage to health and well-being, but also growing inequality.

Equality

The differential vulnerability to environmental hazards of social groups, identified by spheres such as class, ethnicity, and gender, is well established in scientific literature (see, for instance, Thomas et al.'s literature review, 2019). The intersection of multiple dimensions of one's social identity affects their susceptibility to social injustice, which includes *environmental* injustice, or the differential ability of people to experience freedom from environmental risks based on one or more features of their identity.

By definition, environmental injustice shatters equality. Equality is declared a human right in Articles 1 and 2 of the Universal Declaration of Human Rights, which state that "All human beings are born free and equal in dignity and rights" and are entitled to enjoying their rights "without distinction of any kind". Just like health and democracy, equality is recalled in the SDGs, specifically SDG 10: *Reduced Inequality.* Fracking is a prime threat to equality and environmental justice. In this section, we resume our US case studies and turn our attention to two facets of identity, namely ethnicity[1] and socio-economic class. These have been proven to be significant when evaluating the social impacts of fracking in the US, despite heterogeneity in the way and extent to which they play a role in different states (Zwickl, 2019).

In Texas, both factors have meaningful consequences. In a comparative study of four US states based on a limited number of ethnic groups, Zwickl (2019) found that Texas is one of the leading states for environmental injustice directed toward Black people. Johnston et al. (2016) confirm her findings by demonstrating that people recognized as[2] belonging to minorities are disproportionately likely to live in the vicinity of disposal wells for fracking

[1] "Ethnicity" is a slippery concept in social science, as it presents a high risk of being reified and used to wrongly ascribe static and stereotyped characteristics to a group of people. This paper strives to avoid such reification and only uses the term "ethnicity" to refer to how the physical appearance of people affects their rights, causing injustice and inequality.

[2] In many places in the world, among which is Texas, what is considered a "minority" is a "majority" in numerical terms. White American citizens only account for 41,4% of the population (Texas | Data USA, n.d.); yet, they are still considered as the "majority", in a reiteration of power-laden language.

wastewater… and therefore of the associated risks. In Pennsylvania, analyses of ethnicity-based differences in exposure are faced with a very practical obstacle: Pennsylvania is much less ethnically diverse than Texas (Pennsylvania | Data USA, n.d.; Texas | Data USA, n.d.). Nevertheless, environmental injustice exists in other ways: people with lower incomes are disproportionately affected by fracking, especially if living in rural areas (Malin & DeMaster, 2016). Rural communities face a "devil's bargain", in Malin & DeMaster's (2016) evocative words. On one hand, leasing their land to oil corporations provides an opportunity to diversify their income. On the other hand, the price for income diversification is dependence on the big shale oil corporations, "devils" guilty of "corporate bullying", consisting of unclear leasing conditions and unequal shares of participation in deciding on access to the land.

What are the reasons for this environmental injustice? Some explanations place an emphasis on an intuitive economic factor: certain areas might simply be cheaper than others to frack (Castelli, 2015). However, one can dive deeper into the problem to find more complex explanations relating economic factors to political and social ones. The neoliberal agenda allows for a sort of reversal of the relation between state and the market. If the market was subject to state control before the widely studied neoliberal turn of the late 1970s and 1980s, the opposite seems true now. Capitalist corporations are allowed a new level of intrusiveness in politics and are able to form alliances with the state that ordinary citizens find difficult to tackle (Hudgins & Poole, 2014; Malin & DeMaster, 2016). The fluid relation between the government and capitalist powers is a threat not only to equality, but also to democracy, and directly connects to what was covered in one of the previous sections.

Downey and Hawkins (2008) expand research horizons by suggesting an intersectional perspective on the complex interrelations between socio-economic status and ethnicity which cause them to frequently synchronize in shaping environmental inequality.

Previous analyses of their interconnection in shaping vulnerability to fracking one-sidedly attribute the influence of ethnicity to the lower average income of ethnic minorities. Although this is often true, Downey and Hawkins (2008) prove that it is not necessary, as the opposite also occurs; in other words, ethnicity can explain income differences due to the embeddedness of both in wider social frameworks. The interconnectedness of these two factors leads the authors to conclude that poor Black people are the group that is most vulnerable to the consequences of fracking in the United States.

The increased exposure of people belonging to certain social groups to hydraulic fracturing facilities directly results in their inflated exposure to all the related hazards that have been discussed so far. Undemocratic practices of decision-making, deterioration of air quality, depletion of the water reservoir, and heightened seismic risk come together to form part of a circle of structural violence, defined as a form of violence that is not physical, but embedded in social structures. It is a sort of "blanket violence", directed to many and *embodied* by each, precisely like racism or poverty (Farmer, 1996); oftentimes, however, it retains a kind of selectivity, as not all groups in society are equally affected. Scheper-Hughes (2010) powerfully calls structural violence "permissible, even encouraged" and "invisible" (p. 13), because its source is not a person, but a system that escapes accountability. Its peculiar "public subtlety" parallels and intermingles with that of fossil fuels. Let us then undo the distance we placed between us and the system in which we are entangled.

Conclusion

The relationship and interconnection between fracking, environment, and human rights cannot be overstated. While the environmental impacts of the practice might be easier to detect, *people* are also a part of its equation. People and the environment are intertwined in the embrace of the subtly violent structure of neoliberal capitalism; fracking is a prime example of this interconnected condition. Hudgins & Poole (2014) make this crystal-clear in lamenting the discursive reframing of "water, land, air, community, health, and self [...] as sources of profit" (p. 303) in the fracking industry. Furthermore, this quotation provides a guideline to retrace our path through the environmental and human rights implications of fracking and highlight the numerous interrelations between the different sections of this paper.

Following an introduction to the practical functioning of hydraulic fracturing, the discussion proceeded by highlighting its environmental and human rights impacts. In hindsight, we can highlight how the Earth subsystems defined by air, water, and land all have consequences on each of the human rights domains identified as the commons, health, and equality, and that the same consequence can affect all three simultaneously. Air pollution, water contamination, and the destruction of the land threaten human health, interregional and international equality, and democracy at the same time. These interwoven causal links call upon us to reflect on the theme of ethics in a neoliberal era, inviting us to ask ourselves important questions: how come the *commons* are being appropriated? How can we protect everyone's rights and the essential resources they are based on?

The practice of fracking follows from, but also exemplifies, the broader structure within which it is nested; in doing so, it depicts a rather gloomy landscape. This should not, however, become a source of despair; rather, it should offer an opportunity to collectively bring our attention to the public subtlety of unjust structures and make it transparent. Only then will we be able to act to break the cycle of structural violence that suffocates people and the environment, and open for both a new *virtuous* cycle through which their rights can thrive.

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