



The Criminogenic Nature of Food Production Harm Responses: A Case Study of Anaerobic Digestion Technology Subsidies in Northern Ireland

Ekaterina Gladkova

Northumbria University, United Kingdom

Abstract

Meat production in its current shape is burdened with multiple environmental challenges. Technological solutions have been touted as a means of reconciliation of economic growth and environmental sustainability. In Northern Ireland, anaerobic digestion (AD) technology was presented as a solution for more sustainable animal waste management and greenhouse gas emission reduction in the context of the Going for Growth (GfG) agrifood strategy. AD sites were also eligible for the Renewable Obligation Certificates (ROCs) subsidy support scheme. While criminological engagement with the issues around food crime is yet inchoate, even less attention has been paid to the issue of the criminogenic nature of responses to food production harm. The paper fills this lacuna by discussing how an ostensibly positive initiative of incentivising AD through subsidy provision may have criminogenic potential: it may exacerbate environmental harm due to its ineffectiveness for dealing with ammonia emissions from animal waste, and create opportunities for deviance, such as breaches in planning regulation and subsidy fraud.

Keywords

Green criminology; food production harms; renewable energy; intensive farming; anaerobic digestion.

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Introduction

Meat production in its current shape is burdened with multiple environmental challenges. In its intensive form, meat production results in animal harm, in addition to pollution, habitat destruction, soil erosion, and water resource depletion (Ponette-Gonzalez and Fry 2010; Ruhl 2000; Wyatt 2014a). One of the most pressing environmental challenges is animal waste (Berendes et al. 2018), which is forecasted to increase by 40% during 2003–2030 globally (Cox 2019).

Criminological engagement with the issues around food is yet inchoate (Cheng 2011; Croall 2012; Goyes 2018, 2020; Lord, Flores Elizondo and Spencer 2017; van Ruth et al. 2018; Walters 2007). Even less attention has been paid to the criminogenic nature of responses to harms resulting from food production. This paper fills this lacuna by using a green criminological perspective, and discusses how an ostensibly positive initiative of subsidising a technological solution to deal with increasing animal waste may exacerbate environmental harm. The paper also uses a state–corporate crime framework to analyse how subsidy provision may create opportunities for crime (i.e., subsidy fraud and gaming), and discuss the enabling structures that contributed to making the subsidy criminogenic. By connecting the discussion around subsidies to harms associated with meat production intensification, this paper advances both green criminological and state–corporate crime research.

Northern Ireland: Background

Northern Ireland presents an interesting case for scrutinising the challenge of animal waste. Farming in Northern Ireland is organised through small farms, with the average size being half as small as in the rest of the United Kingdom (UK) (Attorp and McAreavey 2020). Yet, this appears to be changing. Between 2008 and 2018, there was an increase in the already-significant dairy herd¹ and a steep increase in pig² and broiler³ numbers. Environmental NGOs and local campaigners attributed these trends to the Northern Irish government's adoption of the Going for Growth (GfG) strategy in 2012. Industry-led, the GfG endeavoured to expand the agrifood sector with the goal of 'growing a sustainable, profitable and integrated Agri-Food supply chain, focused on delivering the needs of the market' (Agri-Food Strategy Board 2013: 11). Growth within the pig and poultry sectors was encouraged, resulting in the number of factory farms increasing by 68%,⁴ which also resulted in larger amounts of animal waste.

Animal waste is a source of harmful emissions linked to air pollution. The problem of ammonia emissions is particularly acute in Northern Ireland. Per capita average ammonia emissions for Northern Ireland are over four times the amount of the other UK nations (Department of Agriculture, Environment and Rural Affairs [DAERA] n.d.). Twelve per cent of total UK ammonia emissions are emitted in Northern Ireland, which is disproportionate to both Northern Ireland's population (3% of the UK total) and its land area (6% of the UK total) (Friends of the Earth 2018b). Farming and agriculture are reported to be the main source of it (93% in 2016) (DAERA and Northern Ireland Environment Agency 2018).⁵ Ammonia emissions in Northern Ireland originate from manure spreading and manure storage, and since the 2010 Agriculture Census, the total nitrogen from animal waste has increased by 10,937 tonnes⁶ (Friends of the Earth 2018b).

Ammonia emissions also have consequences for biodiversity and water pollution. Most of Northern Ireland (89%), including its priority habitats, has levels of nitrogen significantly above its 'critical load' (DAERA n.d.; Rowe et al. 2019). At this rate, significant ecological damage occurs. Additionally, if nitrogen is deposited in large amounts, water bodies become acidic and aquatic biodiversity can be negatively affected (Friends of the Earth 2018a).

Manure land application results in odour and may act as a reservoir for antibiotic residues and bacteria carrying different antibiotic resistance genes (Lima et al. 2020). Ammonia from the livestock manure mixes with other pollutants in the atmosphere, creating small particles known as particulate matter. Particulate matter can be harmful to human lungs when inhaled (DAERA n.d.). It is reported that halving

ammonia emissions in the whole of the UK could prevent at least 3,000 premature deaths from air pollution each year (Wasley, Heal and Lainio 2019).

Taken together, problems of water, soil and air pollution from farming intensification in Northern Ireland create concerns for environmental justice, which has become even more pressing in the context of the GfG (Gladkova 2020). Environmental justice is a green criminological perspective suggesting that addressing environmental harm entails focusing on justice. White (2008: 15) proclaims environmental justice as one of the approaches of green criminology, and defines it as 'the distribution of environments among peoples in terms of access to and use of specific natural resources in defined geographical areas, and the impacts of particular social practices and environmental hazards on specific populations'. Communities in the vicinity of intensive farms are at greater risk of developing health complications (Fitzgerald 2019). Worsening air quality has been associated with respiratory diseases (Mirabelli et al. 2006), and other health consequences may include mood and sleep disorders (Donham et al. 2007). Finally, issues surrounding ecological (with natural ecosystems being the victim of harm) and species (with non-human species being the victim of harm) justice also need to be considered seriously in the context of farming intensification in Northern Ireland.

Rising environmental concerns from farming intensification demanded an urgent response from the agrifood industry and the government, who suggested anaerobic digestion (AD) technology to reconcile economic growth and environmental sustainability through more sustainable animal waste management and greenhouse gas emission reduction. AD is a process in which organic matter (e.g., pig or cattle manure) is broken down by microorganisms in an oxygen-free environment to make biogas and digestate. Biogas can power on-farm operations while the digestate can be applied straight to land as a replacement for artificial fertiliser.

In March 2019, there were 110 accredited AD sites in Northern Ireland (Northern Ireland Audit Office [NIAO] 2020) eligible for the Renewable Obligation Certificates (ROCs) subsidy support scheme. A ROC was 'a green certificate issued to an accredited generator for eligible renewable electricity generated within the [UK] and supplied to customers within the [UK] by a licensed electricity supplier' (Anaerobic Digestion 2020). Northern Ireland had a separate support scheme for renewable electricity projects. The scheme had a different banding to the rest of the UK: facilities with a capacity less than or equal to 500 kW were entitled to four ROCs per megawatt hour; facilities with a capacity of 500 kW to 5 MWe were entitled to three ROCs per megawatt hour; facilities with a capacity of more than 5 MWe were entitled to two ROCs per megawatt hour (Anaerobic Digestion 2020).

Yet, it has been claimed that anaerobic digesters may exacerbate pollution rather than reduce it (Bell et al. 2016; Friends of the Earth 2018c; Source Material 2018). It was calculated that the net additional ammonia emissions from them would be around 696,740 kg (Friends of the Earth 2018b), thus, questioning the effectiveness of AD in reducing animal waste from farming intensification.

Moreover, subsidising AD was reported to be creating opportunities for crime. Allegations of subsidy fraud and gaming in relation to AD subsidies appeared both in the mainstream and investigative media outlets (Curwen 2018; Source Material 2018). The analysis of AD subsidy provision is timely and relevant in the Northern Irish context because of another recent subsidy mishandling scandal around the Renewable Heat Incentive (RHI). The RHI was introduced to encourage generation of heat from renewable sources. Under the terms of devolved legislation, Northern Ireland bears responsibility for its energy matters (Muinzer and Ellis 2017), which allowed the Northern Irish officials to adopt the UK-wide version of the RHI but adjust the financial mechanisms of the scheme (Muinzer 2017). These adjustments resulted in higher payments in subsidies than the cost of the renewable fuel, which encouraged the subsidy beneficiaries to burn more fuel to receive more subsidy (Muinzer 2017; Riley 2017). The subsidy provision was mired in allegations of fraud and ultimately resulted in the collapse of Northern Ireland's devolved government (Muinzer 2017; Riley 2017), costing taxpayers an estimated £490 million. The context of Northern Ireland is also interesting because of its post-conflict governance arrangements, which, to an extent, have contributed to subsidy scheme mishandling. Tonge (2006) claims that recognition and formalisation of

unionist/nationalist divisions resulted in institutional chaos and greater polarisation. Governmental departments are administratively and politically divided from one another as a result of prolonged demands of power sharing, which impedes the decision-making process. The latter in general has a history of being closed and bureaucratic (Foord et al. 2018).

Theoretical Background

Food has only recently started to become an issue on the criminological agenda. The concept of food crime was introduced in 2007 (Croall 2007). Since then, criminologists have gained a better understanding of the criminal acts embedded in the food chain through the analysis of food fraud (Corini and van der Meulen 2019; Flores Elizondo, Lord and Spencer 2018; Leon and Ivy 2017; Lord, Flores Elizondo and Spencer 2017; Rizzuti 2020; Spink and Moyer 2013; van Ruth et al. 2018), food poisoning (Tombs and Whyte 2010), food mislabelling (Croall 2012), food safety (Leighton 2016), and trade practices and environmental law (Walters 2006). Additionally, harms stemming from food production have been explored through the empirical research of exploitation in food production (Hinch 2019; Tombs and Whyte 2007), cruelty to animals (Agnew 1998; Fitzgerald 2019; Schally 2017; Tourangeau and Fitzgerald 2020; Yates 2007), effect of pesticides on farmers (Del Prado-Lu 2019), links between technologies and food (Laestadius, Deckers and Baran 2019; Sun and Liu 2019; Walters 2019), and regulation of food waste (Long and Lynch 2019). Some criminologists have considered the responses generated by food production crime: Barbarossa (2019) outlined consumer responses to food safety scandals; and Booth, Coveney and Paturel (2019) discussed a variety of acts of citizen resistance. Yet, what remains unexplored is the institutional response to food production harm, particularly in relation to ever-increasing meat production. In this paper, the exploration of the criminogenic nature of responses to harms from increasing meat production in Northern Ireland integrates the fields of green criminology and state–corporate crime.

Green criminology provides an academic space for criminologists to explore issues related to the environment (Lynch 1990; South 1998); as a perspective, it shifts the criminological focus to natural environments, re-examines the definition of crime to include acts that are environmentally harmful but legally permitted, and expands the concept of justice in relation to environmental frames (Lynch and Stretesky 2014). Most of the existing green criminological research into meat production focuses on exploitation of non-human animals (Beirne 2014; Schally 2017; Sollund 2012; Wyatt 2014a) and draws on environmental degradation that results from industrial meat production (Goyes and South 2016; Gray and Hinch 2015; Sollund 2015; White 2012; White and Yeates 2019). It has been suggested that green criminology can also contribute to a more nuanced understanding of food crime and the harms it can entail (Tourangeau and Fitzgerald 2020: 205), particularly in cases where ‘no laws are broken, but environmental, physical and social harms result nonetheless’. Environmental harm from subsidising AD is an example of such a case. Spapens et al. (2018) suggest that environmental harm is bound to involve a financial component. Croall (2012) points out the problematic nature of corporate–governmental collusions in relation to subsidies, and Standing (2015) highlights the criminogenic role of private investment and public subsidies in fuelling illegal fishing. It has also been suggested that large public subsidies allow some of the most polluting industries—such as oil, chemical and mining companies—to accumulate profits while being culpable of plundering ecosystems and endangering public health (Ruggiero and South 2013). However, criminogenic potential of subsidies as a response to food production harm needs to be explored further.

Green criminology also invites us to make technology a focus for critical analysis: it suggests that ‘violations against, and protections of, the environment almost always involve a technological dimension’ (White 2013: 241). White (2013) proposes that technology should be considered within wider social, economic and political relations, the examination of which allows us to establish whether technology serves the interests of social and ecological justice or reinforces existing power structures. Technological solutions have been criticised in their attempt to solve the problems of world hunger (Walters 2006), climate change (Brisman and South 2018) and energy production in the form of biofuels (Mol 2013). Therefore, it is important to further this discussion by examining AD subsidies in Northern Ireland and their criminogenic potential in more depth.

Lynch (2019) states that green criminological research overlaps with crimes of the powerful research. As a result, I suggest that the integrated model of state–corporate crime is helpful in analysing how AD subsidy provision may create opportunities for crime and understanding the enabling structures behind it. Michalowski and Kramer (2006: 15) define state–corporate crimes as ‘illegal or socially injurious actions that occur when one or more institutions of political governance pursue a goal in direct cooperation with one or more institutions of economic production and distribution’.

The state–corporate crime scholars locate the origins of crime in the structures of capitalism, in particular its drive for accumulation (Bernat and Whyte 2017). Michalowski and Kramer (2006) suggest that the structure and cultural meanings of the broader political economic arrangements shape the goals and means of economic and political organisation. The integrated framework includes catalysts for crime and harm: motivation (goals), opportunity structure (means) and operationality of control. The analysis is rooted in the assumption that deviance produced by interactions between political and economic actors stems from pressure for goal attainment, availability and attractiveness of illegitimate means, and the weakness of social control (Kauzlarich and Kramer 1998) under the conditions of the political economy of capitalism. The state–corporate crime framework sheds light on the relations of power between economic and political actors, and their symbiotic production of socially and environmentally disadvantageous scenarios. It illuminates the constitutive nature of state–corporate relationships, a hypothesis discussed by several authors (Aulette and Michalowski 1993; Bernat and Whyte 2017; Kramer 1992; Kramer, Michalowski and Kauzlarich 2002; Tombs 2012; Whyte 2014).

In summary, the paper develops a discussion around the criminogenic potential of AD subsidies as a response to expanding meat production, and advances criminological scholarship by integrating the green criminological perspective and the state–corporate crime framework.

Methodology

The paper utilises a case study research design, scrutinising the case of AD subsidies in Northern Ireland. The data material includes (1) grey literature (The *Report of the Independent Public Inquiry into the Non-domestic RHI Scheme*; policy documents related to the GfG strategy; the Northern Ireland Executive action plan in response to the GfG strategy and the strategy’s progress updates; documents related to the environmental regulation of farming; and documents on the subject of the state of the environment and farming intensification in Northern Ireland, produced by Friends of the Earth Northern Ireland) and (2) secondary data, such as the Northern Ireland environmental statistics reports. The analysis of grey literature and secondary data was performed through thematic analysis, which refers to ‘a process of identifying themes in the data which capture meaning that is relevant to a research question, and perhaps also to making links between such themes’ (Willig 2014: 147).

Another vital source of secondary data in the paper are the investigations on AD subsidies: a report by Source Material (2018) titled *Muck for Brass*, and a documentary by BBC Radio 4’s File on 4 titled *Power Games* (Curwen 2018). *Muck for Brass* analysed how agrifood businesses have used a green energy scheme to fuel the expansion of intensive farming in Northern Ireland, focusing on the meat processing company Moy Park. In addition to using publicly available sources, such as documents from the Northern Ireland Assembly, the journalists used interviews with Moy Park officials, speaking notes and documents obtained through a freedom of information request in their investigation and drone footage of farms. Conversely, the *Power Games* documentary focused on green energy facilities that operated without planning approval and subsidy gaming. The journalists used interviews with farmers, NGO representatives and government officials as well as publicly available documents in their investigation. Both investigations and the documents used are publicly available, which posed no ethical challenges.

The value of using investigative sources needs to be examined more closely. The relationship between investigative journalists and academics has traditionally been considered in terms of academics being able to provide knowledge in highly specialised areas (MacFadyen 2008). Yet, investigative journalism can also be of benefit for academics as, similarly to the NGO actors, they can provide an alternative perspective on

regulatory environments (Kauzlarich and Matthews 2006). Chua (2015) suggests that the rigour of investigative reporting can rival or even exceed that of academic research, and investigative journalists have a clearly defined research method that involves documentary analyses, live interviews and site visits. Investigative journalism is particularly valuable in relation to uncovering environmental harms. Tong (2015) suggests that investigative environmental journalism constructs an antagonism against state capitalism and challenges the hegemony of economic growth. Environmental journalism (and investigative journalism in particular) holds the state and corporate actors accountable for environmental destruction, and increases transparency around environmental problems. The latter is of significant value in criminology and here I suggest that more ties should be forged between criminologists and investigative journalists. Yet, critics also question the competence of journalists to undertake tasks of scrutinising authority (de Burgh 2008).

It is also important to reflect on the risks associated with using investigative journalism as a data source. One such risk is the credibility of journalistic sources, as researchers have to trust the professional judgement of the journalist to consider what motives sources might have for lying, or if sources are independent of each other (Bacon 2006). Another risk is the divergence between ethics codes in journalism and academia. Journalists have been found to be more inclined to resort to 'common sense ethics' or take 'situational views' of ethical dilemmas, justifying certain controversial practices they deem necessary in probing matters of public importance (Chua 2020). To mitigate such risks, I contacted the journalists behind Source Material and asked about their ethics code, and further studied the BBC Code of Conduct in regard to conducting ethical reporting.

Anaerobic Digestion Subsidies and Environmental Harm

The environmental impact of AD plants is dependent on many factors, such as choice of substrate, what technology is adopted, and operational practices (Capodaglio, Callegari and Lopez 2016). One of the end products is called digestate, which can be spread on fields as fertiliser. Current research on the pollution potential of the digestate is not conclusive. Some suggest that it is less than that of the original feedstock, yet still very high (Northern Ireland Freshwater Taskforce 2018). Conversely, ammonia emissions from digestate higher than from original manure have been reported in three studies (Paolini et al. 2018). It is suggested that AD prevents the nitrogen loss during the first step of animal manure management; yet, the risk of nitrogen loss is increased during the later steps of manure management and spreading of the digestate (Möller 2015).

It is calculated that 1,869,300 tonnes of digestate will be generated by the 103 AD plants⁷ in Northern Ireland (Friends of the Earth 2018c). If it is disposed of by land spreading, it will result in 1,551,519 kg of ammonia (Friends of the Earth 2018c).⁸ The increase in emissions results from ammonia volatilisation: this process occurs at the soil surface when ammonium from fertilisers (such as digestate) is converted to ammonia gas. Using the case study of anaerobically digested cattle slurry, Matsunaka et al. (2006) reported a 13% nitrogen volatilisation when the digestate was used as soil fertiliser. Moreover, it was calculated that up to 30% of nitrogen can be lost by ammonia volatilisation (Paolini et al. 2018), which can ultimately exacerbate land and water pollution.

Some authors also suggest that if biogas plant digestate is used as fertiliser, hazardous organic compounds may end up in agricultural soil (Paolini et al. 2018). Some of the hazardous organic compounds may have the potential to accumulate in the food chain and in the environment (Suominen, Verta and Marttinen 2014).⁹ To question the potential of AD for mitigating environmental harms in farming even further, the government officials in Northern Ireland suggested that AD 'does not address the fundamental issue of excess nutrients in the manure, as it requires land spreading of the digestate' (DAERA 2014: 19). Therefore, there is a possibility that AD plants, while creating renewable energy, may increase ammonia emissions in Northern Ireland, primarily through the storage of feedstock and digestate, and the land spreading of the latter (Bell et al. 2016).

Another manner in which AD plants can exacerbate environmental harm is by subsidy concentration in the hands of larger farmers: this trend promotes a more intensive form of production, associated with air, land and water pollution, biodiversity losses (Neo and Emel 2017; Ponette-Gonzalez and Fry 2010; Ruhl 2000) and negative implications for the non-human animals (Beirne 2014; Sollund 2012; Wyatt 2014b). It needs to be specified that AD plants in Northern Ireland range from 180 kW to 500 kW capacity. The subsidy mechanism offers the biggest returns for 500 kW digesters (Macauley 2018), and the latter are not suitable for the small farms. This sentiment was expressed by the Ulster Farmers' Union's (UFU) Senior Policy Officer Chris Osborne: 'tariffs were stacked in favour of largest installations. From the outset, the UFU felt that small scale should have been closer to 30 kW and below' (Farming Life 2017: para. 6).

Therefore, lack of consideration of the needs of smaller farmers and lack of support in the subsidy form consolidates the dominance of larger-scale farms, which, in the long run, can be detrimental to the needs of the environment. This trend also reinforces economic relationships within capitalism (Kramer and Michalowski 2012) that, through prioritisation of the interests of profit, create favourable conditions for environmental harm.

Anaerobic Digestion Subsidies and Opportunities for Crime

The administration of AD subsidies may create opportunities for subsidy gaming and fraud. The Source Material (2018) investigation uncovered up to eight 'phantom plants', which existed in name only. They described a situation whereby subsidy beneficiaries were claiming subsidies on the basis of running two independent electricity-generating stations while there were strong grounds for suggesting that in reality it was one plant made of two combined heat and power (CHP) units under common ownership (Curwen 2018). However, the subsidy was provided only to independent generating stations; therefore, a possibility of subsidy gaming opened up through presenting one station comprising two CHP units as two independent stations. To the regulating bodies such as Ofgem, one plant made of two CHP units still qualified as one generating station.¹⁰

The example presented by Source Material (2018) was one of JMW Farms, a progressive group of companies concentrating on pig production within Northern Ireland, the Republic of Ireland and Britain, which was one of the first to adopt AD technology. The company had a single AD plant since 2012, and by 2015 they were generating more waste from pork production than its single 500 kW digester could process. The decision to increase the plant's capacity by adding an extra generator would shift the plant into a lower subsidy band (Source Material 2018). JMW Farms decided to set up a second company, Greencircle Renewables. By 2017, both companies (JMW and Greencircle) were claiming subsidies at the highest rate for two separate 500 kW biogas digesters (Source Material 2018). However, the Source Material investigation claimed that the second plant did not exist:

We went there to County Armagh and drove around to find the two addresses, and it seemed like those two roads are simply two different ways into the same place—it's called the Tonnagh Pig Unit, owned by JMW Farms Ltd. Satellite pictures seem to confirm this and show no evidence of a second dome-shaped AD plant. No planning application has been made for a second anaerobic digester. ... One of the things the Ofgem Renewable Obligation guidance uses to determine what constitutes a generating station is whether it's previously been accredited. Ofgem appear to believe there are two different stations here, so two different subsidies. That seems to be because they each have a different postcode, so in that sense they aren't on the same site. (Curwen 2018)

An investigation has been called into the possibility that the subsidy scheme could be exploited, and 14 of the 89 plants have been audited (Macauley 2018). The Department for the Economy (2019: 67) claimed that site inspections have disproved claims made by investigative journalists, and stated that 'Ofgem continues to work on the allegation about pairs of sites operating in close proximity. The information gathered to date suggests that any need to reclassify two separate plants as one is likely to be very limited.' Yet, the recent NIAO (2020: 7) report confirmed that the 'allegations did lead to the identification of an

issue of “gaming”¹¹ at two generating stations in close proximity, with Ofgem concluding that the stations should be accredited as one station’.

Discussion

It is important to analyse the structural factors around subsidy provision in Northern Ireland to understand how responses to harms from expanding meat production under a GfG strategy may become criminogenic. First, as mentioned, energy is a devolved matter in Northern Ireland. It is devolved under the terms of the devolving legislation and is characterised by complex governance mechanisms due to its cross-cutting nature, thus, involving areas such as planning and housing (Muinzer 2017).

Northern Ireland possesses extensive devolved energy competence that surpasses the powers that have been devolved to Scotland and Wales (Muinzer 2017). This allows the Northern Irish officials to deploy their influence for modifying certain energy-related matters. In 2011, the government increased subsidy payments to at least double the level of those in the rest of the UK (Macauley 2018). The discourse around AD focused on the ability of technology to mitigate environmental challenges, particularly in the context of expanding meat production. The provision of subsidy was framed to be for the greater good of protection of the environment, which resonates with White’s (2013) critique of technological optimism and the idea of technology as a fix. Within it, technological innovation becomes the way to guarantee both the continued exploitation of nature and respond to its demise (White 2013).

Second, during the earlier mentioned RHI scandal, the influence of the agrifood industry on the government was revealed. The economic clout exercised by the industry ‘makes them potent claimants on the public trough and potent influencers on the list of public expenditures’ (Schnaiberg 1980: 246). In the Northern Irish case, lobbying for biogas by the major meat processing companies was intended as a strategy to circumvent the European Union’s (EU) Nitrates Directive (designed to protect water quality in the EU) and pursue goals of expansion under the GfG strategy (Source Material 2018). The profit- and growth-oriented political economy of capitalism plays a role in creating structural conditions for harm (Bernat and Whyte 2017); any interference with the pursuit of profit-making (including the health of the environment) is sacrificed (Lynch et al. 2017). In this case, rising emissions were an impediment for the expanding meat industry, which needed to be overcome.

Embeddedness in the global political economy of capitalism also influences the relationship between the state and economic actors (Michalowski and Kramer 2006). It was suggested that the government create a team of officials to help one of the poultry companies, Moy Park, expand its operations in the context of the GfG strategy and simultaneously meet its EU obligations under the Nitrates Directive (Source Material 2018). Between September 2014 and April 2017, Moy Park held 14 meetings with DAERA officials in which AD was discussed as a strategy for meeting the obligations under the Nitrates Directive (Source Material 2018). In 2015, the major figures in the agrifood industry successfully lobbied the government to keep subsidies at the top level, by which time they were four times higher than anywhere else in the UK (Source Material 2018). Close ties between the government and the agrifood industry guaranteed that the expansion of meat production went ahead, despite the environmental harms described above. The subsidy contributed to non-disruption of production by legitimising the industry’s activities and simultaneously financing the industry’s expansion and development. Industry–state relations constitute an opportunity structure, in which collaboration between government and capital at both an institutional and an individual level works to facilitate the motivation of economic success in farming, and results in state–corporate environmental harm (Kramer and Michalowski 2012). Moreover, the subsidy could be regarded as a stepping stone towards further capital accumulation in the hands of the minority. As stated, the AD scheme benefitted large-scale farmers, which resonates with Michalowski’s (2018) analysis of how power is organised under the state–corporate ‘symbiosis’. Both investigations (Curwen 2018; Source Material 2018) as well as research (Attorp and McAreavey 2020) emphasised the role of meat processing companies as well as investment funds in benefitting most from the arrangements around AD subsidies.

Further, intersection of economic and political power is reported to decrease the likelihood of regulation of harmful behaviour (Kramer, Michalowski and Kauzlarich 2002). Flaws in the broader regulatory controls serve as a catalyst for harm (Michalowski and Kramer 2006). Lack of oversight from the central government office Ofgem plays a significant role in contributing to the criminogenic nature of AD subsidies. In their annual report, Ofgem (2019b) suggest that each year they administer a program of audits of generating stations. In 2017–2018, 140 generating stations were audited, 36 of which were in Northern Ireland. It is suggested that Ofgem may be reluctant to audit certain parts of the country, such as Orkney, Shetland, the Western Isles of Scotland, and Northern Ireland as well (Curwen 2018). Moreover, upon receiving an application for biogas subsidies, Ofgem's initial controls go no further than checking whether two applicants share a postcode (Source Material 2018), which may also be evidence of weak controls. Once again, in relation to the RHI Inquiry, it was noted that Ofgem failed to develop and implement a fraud prevention strategy that addressed the risks specific to Northern Ireland, potentially exposing the scheme to a greater risk of abuse (Coughlin et al. 2020: 200).¹² Passas and Nelken (1993) suggest that if the structural arrangements operate in a manner that allows some people and organisations to break the rules with impunity while making gains in the process, it can be expected that more fraud will occur. Thus, the RHI Inquiry reveals the flawed nature of the structural factors around subsidy provision in Northern Ireland, which may escalate the criminogenic potential of administering AD subsidies as a response to harms from expanding meat production under the GfG strategy.¹³

Conclusion

This paper has considered the criminogenic potential of AD subsidies in Northern Ireland as an instrument to respond to environmental harms associated with animal waste from expanding meat production under the GfG agrifood strategy. While active promotion of AD may escalate the existing emissions problem, it can also create new risks, such as sanitary and ecological risks associated with the presence of antimicrobial-resistant bacteria in the digestate spread on land (Resende et al. 2014). Thus, the reliance on technology for addressing environmental degradation is not effective: capitalism produces ecological disorganisation even alongside the advances in green technology (Heydon 2019; Stretesky, Long and Lynch 2013). Rather, reliance on technology in this case suggests that the capitalist commitment to economic growth can continue unchanged.

Moreover, the paper has shown that the structural factors around subsidy provision in Northern Ireland may create opportunities for deviance in the form of subsidy gaming and fraud. Such opportunities are created as a result of the devolution of energy matters to the Northern Irish government where the existing schemes can be modified to increase their benefit. Additionally, the small political environment in Northern Ireland results in a clientelistic relationship between the government and the agrifood industry. The intersection of political and economic power results in the industry actors and the state cooperating in the creation of the opportunity structure to maintain a smooth functioning of the capitalist system of production (Bittle et al. 2018; Tombs 2015). Provision of AD subsidies is part of such an opportunity structure that ultimately aims to create economic growth by expanding meat production in the country. Atorp and MacAreavey (2020: 308) claim that 'the AD scheme ... allowed large agribusinesses to fuel the expansion of intensive practices', thus, proving the conclusions made by state–corporate crime theorists about the constitutive nature of state–corporate power relations. Finally, the paper demonstrated that AD subsidy provision in Northern Ireland can become criminogenic because of insufficient centralised controls. Both of these conclusions resonate with the conclusions drawn by state–corporate crime theorists that opportunities for deviance are expanded if the possibility of constraint disintegrates in regulatory structures (Ruggiero 2015).

Correspondence: Ekaterina Gladkova, PhD, Lecturer, Faculty of Arts, Design, and Social Sciences at Northumbria University in Newcastle, B1307, Northumbria University, Newcastle City Campus, 2 Sandyford Road, Newcastle upon Tyne NE1 8SB, United Kingdom. gladkovaka@gmail.com

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- ¹ From 289,200 to 310,700 animals (Playfair 2019).
- ² From 402,400 to 633,600 animals (Playfair 2019).
- ³ From 11,543,000 to 17,663,000 animals (Playfair 2019).
- ⁴ From 154 in 2011 to 259 in 2017 (Davies and Wasley 2017).
- ⁵ Nitrates are produced as part of a wider nitrogen cycle. The nitrogen cycle is the biochemical cycle by which nitrogen is converted into its multiple forms as it circulates among the atmospheric, terrestrial and marine ecosystems. There are two main forms of nitrogen: organic and inorganic. Organic nitrogen is found in proteins and is continually recycled by plants and animals. Inorganic nitrogen occurs as nitrogen (N₂) nitrate (NO₃⁻), nitrite (NO₂⁻), ammonia (NH₃⁺) and ammonium (NH₄⁺) (Crohn 2004). If nitrogen—in the form of ammonia, one of the gaseous nitrogen oxides, or nitrates or nitrites—is highly concentrated, it can have a damaging effect on ecosystems and the organisms that depend on them.
- ⁶ With 51% of the increase from poultry, 24% from pigs and 10% from cattle.
- ⁷ At the time of the report there were 103 rather than 110 accredited facilities.
- ⁸ Available estimates suggest that loss of biodiversity due to ammonia emissions could have effects in the UK that can be valued, conservatively, at between £0.20 and £4 per kilogram of ammonia. Combining this with the monetised health effects, the conservative estimate of the total costs from both health and biodiversity effects of ammonia in the UK is £2.50 per kilogram of ammonia (though the range of possible values is from £2 to £56 per kilogram) (Guthrie et al. 2018).
- ⁹ To contrast these claims, Johansen et al. (2013) state that using digestate as fertiliser had only small and transient changes in the soil.
- ¹⁰ Ofgem (2019a: 13) specify that ‘we will presume that sets of equipment for generating electricity are ordinarily one generating station if they are on the same premises and where they are owned and or operated by the same or connected or associated or related people’.
- ¹¹ ‘Gaming arose where two or more separate generating stations fuelled by biogas produced from AD were accredited in order to obtain a higher rate of ROCs when in reality there was only one generating station which should have received the lower rate’ (Northern Ireland Audit Office 2020: 7).
- ¹² It was pointed out that there were allegations of widespread fraud and abuse of the scheme, and in one case ‘Ofgem were also aware that “it could be politically sensitive given that the installation’s authorised signatory is a Special Adviser to the First Minister of Northern Ireland”’ (Coghlin, O’Brien and MacLean 2020: 89). As a result, Ofgem were accused of withholding relevant information from the Police Service of Northern Ireland.
- ¹³ The Inquiry found that ‘corrupt or malicious activity on the part of officials, Ministers or Special Advisers was not the cause of what went wrong with the [Northern Ireland Renewable Heat Incentive] (RHI) scheme (albeit the Inquiry has identified some instances where behaviour was unacceptable)’ (Coghlin, O’Brien and MacLean 2020: 201). Nevertheless, it identified accumulation of errors and omissions and failure to address those to be the cause of the RHI scandal.

References

- Agnew R (1998) The causes of animal abuse: A social-psychological analysis. *Theoretical Criminology* 2(2): 177–209. <https://doi.org/10.1177/1362480698002002003>
- Agri-Food Strategy Board (2013) *Going for growth: A strategic action plan in support of the Northern Ireland agri-food industry*. <https://www.daera-ni.gov.uk/sites/default/files/publications/dard/going-for-growth.pdf>
- Anaerobic Digestion (2020) *Incentives*. <http://www.biogas-info.co.uk/about/incentives/>
- Attorp A and McAreavey R (2020) Muck, brass and smoke: Policy post-exceptionalism in the agri-food sector. *Journal of Rural Studies* 79: 302–310. <https://doi.org/10.1016/j.jrurstud.2020.08.050>
- Aulette J and Michalowski R (1993) The imperial chicken fire: States, corporations, and public health. In Tunnell K (ed.) *Political crime in contemporary America*: 177–207. New York: Garland Press.
- Bacon W (2006) Journalism as research. *Australian Journalism Review* 28(2): 147–157.
- Bain M (2018) *Scheme labelled ‘RHI on steroids’ to be examined*. *Belfast Telegraph*, 22 December. <https://www.belfasttelegraph.co.uk/news/northern-ireland/scheme-labelled-rhi-on-steroids-to-be-examined-37649841.html>
- Barbarossa C (2019) Consumer reactions to food safety scandals: A research model and moderating effects. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 385–402. Bristol: Policy Press.

- BBC News (2016, 23 December) *RHI scandal: RHI 'cash for ash' scandal to cost NI taxpayers £490m*. <https://www.bbc.co.uk/news/uk-northern-ireland-38414486>
- Beirne P (2014) Theriocide: Naming animal killing. *International Journal for Crime, Justice and Social Democracy* 3(2): 49–66. <https://doi.org/10.5204/ijcjsd.v3i2.174>
- Bell MW, Tang YS, Dragosits U, Flechard CR, Ward P and Braban CF (2016) Ammonia emissions from an anaerobic digestion plant estimated using atmospheric measurements and dispersion modelling. *Waste Management* 56: 113–124. <https://doi.org/10.1016/j.wasman.2016.06.002>
- Berendes DM, Yang PJ, Lai A, Hu D and Brown J (2018) Estimation of global recoverable human and animal faecal biomass. *Nature Sustainability* 1: 679–685. <https://doi.org/10.1038/s41893-018-0167-0>
- Bernat I and Whyte D (2017) State-corporate crime and the process of capital accumulation: Mapping a global regime of permission from Galicia to Morecambe Bay. *Critical Criminology* 25: 71–86. <https://doi.org/10.1007/s10612-016-9340-9>
- Bittle S, Snider L, Tombs S and Whyte D (2018) *Revisiting crimes of the powerful: Marxism, crime and deviance*. London: Routledge.
- Booth S, Coveney J and Paturel D (2019) Counter crimes and food democracy: Suspects and citizens remaking the food system. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 367–384. Bristol: Policy Press.
- Brey PAE (2017) Sustainable technologies for sustainable lifestyles. In Kaplan D (ed.) *Philosophy, technology and the environment*: 191–212. London: MIT Press.
- Brisman A and South N (2018) Green criminology and environmental crimes and harms. *Sociology Compass* 13(1): 1–12: e12650. <https://doi.org/10.1111/soc4.12650>
- Capodaglio AG, Callegari A and Lopez MV (2016) European framework for the diffusion of biogas uses: Emerging technologies, acceptance, incentive strategies, and institutional-regulatory support. *Sustainability* 8(4): 298–315. <https://doi.org/10.3390/su8040298>
- Carolan M (2012) *The sociology of food and agriculture*. London: Routledge.
- Carroll R (2018) Green energy subsidies fuel rise of Northern Ireland mega-farms. *The Guardian*, 16 November. <https://www.theguardian.com/environment/2018/nov/16/green-energy-subsidies-fuel-rise-of-northern-ireland-mega-farms>
- Cheng H (2011) Cheap capitalism: A sociological study of food crime in China. *British Journal of Criminology* 52(2): 254–273. <https://doi.org/10.1093/bjc/azr078>
- Chua YT (2015) Investigative journalism as academic research output? That will be the day. *Asia Pacific Media Educator* 25(1): 13–20. <https://doi.org/10.1177/1326365X15575565>
- Chua YT (2020) Research Ethics in Investigative Journalism. In Iphofen R (eds) *Handbook of Research Ethics and Scientific Integrity*: 1–18. Basel: Springer.
- Coghlin P, O'Brien U and MacLean K (2020) *The report of the Independent Public Inquiry into the Non-domestic Renewable Heat Incentive (RHI) Scheme*. Volume 3. https://cain.ulster.ac.uk/issues/politics/docs/rhi/2020-03-13_RHI-Inquiry_Report-V3.pdf
- Corini A and van der Meulen B (2019) Regulating food fraud: Public and private law responses in the EU, Italy and the Netherlands. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 159–174. Bristol: Policy Press.
- Cox D (2019) The planet's prodigious poo problem. *The Guardian*, 25 March. <https://www.theguardian.com/news/2019/mar/25/animal-waste-excrement-four-billion-tonnes-dung-poo-facebook>
- Croall H (2007) Victims of white-collar and corporate crime. In Davies P, Francis P and Greer C (eds) *Victims, crime and society*: 78–108. London: SAGE.
- Croall H (2012) Food crime: A green criminology perspective. In South N and Brisman A (eds) *Routledge international handbook of green criminology*: 167–183. Abingdon: Routledge.
- Crohn D (2004) Nitrogen mineralization and its importance in organic waste recycling. Proceedings, National Alfalfa Symposium, 13-5 December 2004, San Diego, CA.
- Curwen L (2018) *Power games*. File on 4, BBC Radio 4. Podcast: MP3 audio, 18 November. <https://www.bbc.co.uk/programmes/m00013rf>
- Davies M and Wasley A (2017) Intensive farming in the UK, by numbers. *The Bureau of Investigative Journalism*, 17 July. <https://www.thebureauinvestigates.com/stories/2017-07-17/intensive-numbers-of-intensive-farming>
- de Burgh H (2008) *Investigative journalism*. New York: Routledge.
- Del Prado-Lu JL (2019) Impact of hazardous substances and pesticides on farmers and farming communities. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food Industry and what to do about them*: 93–108. Bristol: Policy Press.
- Department for the Economy (2019) *Department for the Economy annual report and accounts for the year ended 31 March 2019*. <https://www.niauditoffice.gov.uk/sites/niao/files/DfE-annual-report-and-accounts-2018-19.pdf>

- Department of Agriculture, Environment and Rural Affairs (n.d.) *Ammonia emissions in Northern Ireland*. <https://www.daera-ni.gov.uk/articles/ammonia-emissions-northern-ireland>
- Department of Agriculture, Environment and Rural Affairs (2014) *Review of alternative technologies to fluidised bed combustion for poultry litter utilisation/disposal*. <https://www.daera-ni.gov.uk/sites/default/files/publications/dard/review-of-alternative-technologies-for-poultry-litter-final-jan-2012.pdf>
- Department of Agriculture, Environment and Rural Affairs and Northern Ireland Environment Agency (2018) *Northern Ireland environmental statistics report*. https://www.daera-ni.gov.uk/sites/default/files/publications/daera/ni-environmental-statistics-report-2018_1.pdf
- Donham KJ, Wing S, Osterberg D, Flora JL, Hodne C, Thu KM and Thorne PS (2007) Community health and socioeconomic issues surrounding concentrated animal feeding operations. *Environmental Health Perspectives* 115(2): 317–320. <https://doi.org/10.1289/ehp.8836>
- Farming Life (2017, 12 December) *What is the future for farm-scale AD in Northern Ireland?* <https://www.farminglife.com/ufu-watch/what-is-the-future-for-farm-scale-ad-in-northern-ireland-1-8186268>
- Fitzgerald AJ (2019) *Animal advocacy and environmentalism*. Cambridge: Polity Press.
- Flores Elizondo CJ, Lord N and Spencer J (2018) Food fraud and the Fraud Act 2006: Complementarity and limitations. In Monaghan C and Monaghan N (eds) *Financial crime and corporate misconduct: A critical evaluation of fraud legislation*: 48–62. Abingdon: Routledge.
- Food W, Barry J and Shortall S. (2018) *The Climate-Energy-Food Security Nexus: Report on multi-stakeholder scenario planning workshops in Northern Ireland*. <https://www.thenexusnetwork.org/wp-content/uploads/2018/08/QUB-Nexus-project-report-final.pdf>
- Friends of the Earth (2018a, 26 October) *Fighting the pig slurry in Northern Ireland*. <https://friendsoftheearth.uk/northern-ireland/fighting-pig-slurry-northern-ireland>
- Friends of the Earth (2018b) *Northern Ireland's dirty secret*. <https://ejni.net/wp-content/uploads/2019/06/Northern-Irelands-Dirty-Secret.pdf>
- Friends of the Earth (2018c) *Submission to the Environmental Audit Committee's nitrates inquiry*. <https://ejni.net/wp-content/uploads/2019/06/submission-to-EAC-nitrates-inquiry.pdf>
- Gladkova E (2020) Farming intensification and environmental justice in Northern Ireland. *Critical Criminology* 28: 445–461. <https://doi.org/10.1007/s10612-020-09488-3>
- Goyes DR (2018) 'Tactics rebounding' in the Colombian defence of seed freedom. *International Journal for Crime, Justice and Social Democracy* 7(1): 91–107. <https://doi.org/10.5204/ijcjsd.v7i1.425>
- Goyes DR (2020) Monopolising seeds, monopolising society: A guide to contemporary criminological research of biopiracy. In South N and Brisman A (eds) *Routledge international handbook of green criminology*. 2nd ed. Oxon: Routledge.
- Goyes DR and South N (2016) Land-grabs, biopiracy and the inversion of justice in Colombia. *The British Journal of Criminology* 56(3): 558–577. <https://doi.org/10.1093/bjc/azv082>
- Gray A (2019) Responding to food crime and the threat of the 'food police'. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 403–420. Bristol: Policy Press.
- Gray A and Hinch R (2015) Agribusiness, governments and food crime: A critical perspective. In Sollund RA (ed) *Green harms and crimes*: 97–116. London: Palgrave Macmillan.
- Guthrie S, Giles S, Dunkerley F, Tabaqchali H, Harshfield A, Ioppolo B, Manville C (2018) *Impact of ammonia emissions from agriculture on biodiversity: An evidence synthesis*. https://www.rand.org/pubs/research_reports/RR2695.html
- Heydon J (2019) *Sustainable development as environmental harm: Rights, regulation, and injustice in the Canadian oil sands*. London: Routledge.
- Hinch R (2019) Chocolate, slavery, forced labour, child labour and the state. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 77–93. Bristol: Policy Press.
- Ihara I, Umestu K, Kanamura K and Watanabe T (2006) Electrochemical oxidation of the effluent from anaerobic digestion of dairy manure. *Bioresource Technology* 97(12): 1360–1364. <https://doi.org/10.1016/j.biortech.2005.07.007>
- Johansen A, Carter MS, Jensen ES, Hauggard-Nielsen H and Ambus P (2013) Effects of digestate from anaerobically digested cattle slurry and plant materials on soil microbial community and emission of CO₂ and N₂O. *Applied Soil Ecology* 63: 36–44. <https://doi.org/10.1016/j.apsoil.2012.09.003>
- Kauzlarich D and Kramer R (1998) *Crimes of the American nuclear state: At home and abroad*. Boston: Northeastern University Press.

- Kauzlarich D and Matthews RA (2006) Taking stock of theory and research. In Michalowski RJ and Kramer RC (eds) *State-corporate crime: Wrongdoing at the intersection of business and government*: 239–249. New Brunswick: Rutgers University Press.
- Kramer R (1992) The space shuttle *Challenger* explosion: A case study of state-corporate crime. In Schelgel K and Weisburd D (eds) *White collar crime reconsidered*: 214–243. Boston: Northeastern University Press.
- Kramer RC, Michalowski RJ and Kauzlarich D (2002) The origins and development of the concept and theory of state-corporate crime. *Crime and Delinquency* 48(2): 263–282.
<https://doi.org/10.1177/0011128702048002005>
- Kramer R and Michalowski R (2012) Is Global Warming a State-Corporate Crime? In White R (ed) *Climate Change from a Criminological Perspective*: 187–202. New York, London: Springer International Publishing.
- Laestadius L, Deckers J and Baran S (2019) Food crimes, harms and carnist technologies. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 295–313. Bristol: Policy Press.
- Leighton P (2016) Mass salmonella poisoning by the Peanut Corporation of America: State-corporate crime involving food safety. *Critical Criminology* 24(1): 75–91. <https://doi.org/10.1007/s10612-015-9284-5>
- Leon KS and Ivy K (2017) Food fraud and the partnership for a ‘healthier’ America: A case study in state-corporate crime. *Critical Criminology* 25(3): 393–410. <https://doi.org/10.7282/t3-09g8-w502>
- Lima T, Domingues S and Da Silva G J (2020) Manure as a Potential Hotspot for Antibiotic Resistance Dissemination by Horizontal Gene Transfer Events. *Veterinary sciences* 7(3): 110. <https://doi.org/10.3390/vetsci7030110>
- Long MA and Lynch MJ (2019) Food waste (non)regulation. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 331–346. Bristol: Policy Press.
- Lord N, Flores Elizondo CJ and Spencer J (2017) The dynamics of food fraud: The interactions between criminal opportunity and market (dys)functionality in legitimate business. *Criminology and Criminal Justice* 17(5): 605–623. <https://doi.org/10.1177/1748895816684539>
- Lynch MJ (1990) The greening of criminology: A perspective on the 1990s. *The Critical Criminologist* 2(3): 3–12.
- Lynch MJ (2019) Green criminology and environmental crime: Criminology that matters in the age of global ecological collapse. *Journal of White Collar and Corporate Crime* 1(1): 50–61.
<https://doi.org/10.1177/2631309X19876930>
- Lynch MJ, Long MA, Stretesky PB and Barrett KL (2017) *Green criminology*. Oakland: University of California Press.
- Lynch MJ and Stretesky PB (2014) *Exploring green criminology: Toward a green criminological revolution*. Farnham: Ashgate.
- Macauley C (2018) *Auditor calls for an investigation into anaerobic digester subsidies*. BBC News, 15 November.
<https://www.bbc.co.uk/news/uk-northern-ireland-46213976>
- MacFadyen G (2008) The practices of investigative journalism. In de Burgh H (ed.) *Investigative journalism*: 138–156. 2nd ed. New York: Routledge.
- Matsunaka T, Sawamoto T, Ishimura H, Takakura K and Takekawa A (2006) Efficient use of digested cattle slurry from biogas plant with respect to nitrogen recycling in grassland. *International Congress Series* 1293: 242–252.
<https://doi.org/10.1016/j.ics.2006.03.016>
- Michalowski R (2018) Power, crime and enclosure. Capital accumulation in the twilight of the neoliberal SSA. In Bittle S (ed) *Crimes of the powerful*: 412–428. London: Routledge.
- Michalowski R and Kramer R (2006) *State-corporate crime: Wrongdoing at the intersection of business and government*. New Brunswick: Rutgers University Press.
- Mirabelli MC, Wing S, Marshall SW and Wilcosky TC (2006) Race, poverty, and potential exposure of middle-school students to air emissions from confined swine feeding operations. *Environmental Health Perspectives* 114(4): 591–596. <https://doi.org/10.1289/ehp.8586>
- Mol H (2013) ‘A gift from the tropics to the world’: Power, harm, and palm oil. In Walters R, Westerhuis D and Wyatt T (eds) *Emerging issues in green criminology*: 242–260. London: Palgrave Macmillan.
- Möller K (2015) Effects of anaerobic digestion on soil carbon and nitrogen turnover, N emissions, and soil biological activity. A review. *Agronomy for Sustainable Development* 35(3): 1021–1041. <https://doi.org/10.1007/s13593-015-0284-3>
- Muinzer TL (2017) Incendiary developments: Northern Ireland’s renewable heat incentive, and the collapse of the devolved government. *E-Law Newsletter* 99: 18–21.
- Muinzer TL and Ellis G (2017) Subnational governance for the low carbon energy transition: Mapping the UK’s ‘Energy Constitution’. *Environment and Planning C: Politics and Space* 35(7): 1176–1197.
<https://doi.org/10.1177/2399654416687999>
- Neo H and Emel J (2017) *Geographies of meat: Politics, economy and culture*. Abingdon and New York: Routledge.
- Northern Ireland Audit Office (2020, 13 October) *Generating electricity from renewable energy*.
<https://www.niauditoffice.gov.uk/publications/generating-electricity-renewable-energy-0>

- Northern Ireland Freshwater Taskforce (2018) *Environmental audit committee: Nitrates inquiry*. <https://nienvironmentlink.org/cmsfiles/NIEL-FWTF-Nitrates-Inquiry-Response.pdf>
- Ofgem (2019a) *Guidance for generators that receive or would like to receive support under the Renewables Obligation (RO) scheme*. https://www.ofgem.gov.uk/sites/default/files/docs/2019/04/ro_generator_guidance_apr19.pdf
- Ofgem (2019b) *Renewables obligation (RO) annual report 2017–18*. <https://www.ofgem.gov.uk/publications/renewables-obligation-ro-annual-report-2017-18>
- Paolini V, Petracchini F, Segreto M, Tomassetti L, Naja N and Cecinato A (2018) Environmental impact of biogas: A short review of current knowledge. *Journal of Environmental Science and Health* 53(10): 899–906. <https://doi.org/10.1080/10934529.2018.1459076>
- Passas N and Nelken D (1993) The thin line between legitimate and criminal enterprises: Subsidy frauds in the European community. *Crime Law and Social Change* 19(3): 223–243.
- Playfair D (2019) *Northern Ireland agri-food sector: Key statistics, July 2019*. Belfast: Department of Agriculture, Environment and Rural Affairs. <https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Key%20Statistics%20for%202019.pdf>
- Ponette-Gonzalez AG and Fry M (2010) Pig pandemic: Industrial hog farming in eastern Mexico. *Land Use Policy* 27(4): 1107–1110. <https://doi.org/10.1016/j.landusepol.2010.02.007>
- Resende JA, Silva VL, Lopes T, de Oliveira TLR, de Oliveira Fortunato S, da Costa Carneiro J, Otenio MH and Galuppo Diniz C (2014) Prevalence and persistence of potentially pathogenic and antibiotic resistant bacteria during anaerobic digestion treatment of cattle manure. *Bioresource Technology* 153: 284–291. <https://doi.org/10.1016/j.biortech.2013.12.007>
- Riley J (2017) *Cash-for-ash scandal implicates poultry farmers*. *Poultry World*, 22 February. <https://www.poultryworld.net/UK/Articles/2017/2/Cash-for-ash-scandal-implicates-poultry-farmers-97668E/>
- Rizzuti A (2020) Food crime: A review of the UK institutional perception of illicit practices in the food sector. *Social Sciences* 9(7): 1–10. <https://doi.org/10.3390/socsci9070112>
- Rowe E, Sawicka K, Mitchell Z, Smith R, Dore T, Banin LF and Levy P (2019) Trends report 2019: Trends in critical load and critical level exceedances in the UK. *Report to Defra under Contract AQ0843, CEH Project NEC05708*.
- Ruggiero V (2015) *Power and crime*. London and New York: Routledge.
- Ruggiero V and South N (2013) Green criminology and crimes of the economy: Theory, research and praxis. *Critical Criminology* 21(3): 359–373. <https://doi.org/10.1007/s10612-013-9191-6>
- Ruhl JB (2000) Farms, their environmental harms, and environmental law. *Ecology Law Quarterly* 27(2): 263–350.
- Schally JL (2017) *Legitimizing corporate harm: The discourse of contemporary agribusiness*. London: Palgrave Macmillan.
- Schnaiberg A (1980) *The environment, from surplus to scarcity*. New York: Oxford University Press.
- Shi L, Simplicio WS, Guangxue W, Zhenhu H, Hongying H and Xinmin Z (2018) Nutrient recovery from digestate of anaerobic digestion of livestock manure: A review. *Current Pollution Reports* 4(2): 74–83. <https://doi.org/10.1007/s40726-018-0082-z>
- Sollund RA (2012) Speciesism as doxic practice versus valuing difference and plurality. In Ellefsen R, Sollund RA and Larsen G (eds) *Eco-global crimes: Contemporary problems and future challenges*: 91–113. Surrey: Ashgate.
- Sollund RA (2015) *Green harms and crimes: Critical criminology in a changing world*. London: Palgrave Macmillan.
- Source Material (2018, 13 November) *Muck for brass*. <https://www.source-material.org/blog/muck-for-brass>
- South N (1998) A green field for criminology? A proposal for a perspective. *Theoretical Criminology* 2(2): 211–233. <https://doi.org/10.1177/1362480698002002004>
- Spapens T, White R, van Uhm D and Huisman W (2018) *Green crimes and dirty money*. London: Routledge.
- Spink J and Moyer DC (2013) Understanding and combating food fraud. *Food Technology* 67(1): 30–35.
- Standing A (2015) Mirage of pirates: State-corporate crime in West Africa's fisheries. *State Crime* 4(2): 175–197. <https://doi.org/10.13169/statecrime.4.2.0175>
- Stretesky PB, Long MA and Lynch MJ (2013) *The treadmill of crime: Political economy and green criminology*. Abingdon: Routledge.
- Sun J and Liu X (2019) Technology, novel food and crime. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 281–294. Bristol: Policy Press.
- Suominen K, Verta M and Marttinen S (2014) Hazardous organic compounds in biogas plant end products: Soil burden and risk to food safety. *Science of the Total Environment* 491–492: 192–199. <https://doi.org/10.1016/j.scitotenv.2014.02.036>
- Tombs S (2012) State-corporate symbiosis in the production of crime and harm. *State Crime* 1(2): 170–195.
- Tombs S (2015) *Social protection after the crisis: Regulation without enforcement*. Bristol: Policy Press.
- Tombs S and Whyte D (2007) *Safety crime*. Cullompton: Willan.
- Tombs S and Whyte D (2010) Crime, harm and corporate power. In Muncie J, Talbot D and Walters R (eds) *Crime: Local and global*: 137–172. Cullompton: Willan.

- Tonge J (2006) Sinn Féin and 'New Republicanism' in Belfast. *Space and Polity* 10(2): 135-147. <https://doi.org/10.1080/13562570600921527>
- Tourangeau W and Fitzgerald AJ (2020) Food crime and green criminology. In Brisman A and South N (eds) *Routledge international handbook of green criminology*: 205–221. 2nd ed. Abingdon, Oxon and New York: Routledge.
- van Ruth SM, Luning PA, Silvis ICJ, Yang Y and Huisman W (2018) Differences in fraud vulnerability in various food supply chains and their tiers. *Food Control* 84: 375–381. <https://doi.org/10.1016/j.foodcont.2017.08.020>
- Walters R (2006) Crime, bio-agriculture and the exploitation of hunger. *The British Journal of Criminology* 46(1): 26–45. <https://doi.org/10.1093/bjc/azi049>
- Walters R (2007) Food crime, regulation and the biotech harvest. *European Journal of Criminology* 4(2): 217–235. <https://doi.org/10.1177/1477370807074856>
- Walters R (2019) Food, genetics and knowledge politics. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 265–280. Bristol: Policy Press.
- Wasley A, Heal A and Lainio M (2019) Deadly gas: Cutting farm emissions in half could save 3,000 lives a year. *The Bureau of Investigative Journalism*, 13 June. <https://www.thebureauinvestigates.com/stories/2019-06-13/deadly-gas-ammonia-cutting-farm-emissions-could-save-3000-lives-a-year>
- White R (2008) *Crimes against Nature: Environmental Criminology and Ecological Justice*. Devon: Willan Publishing.
- White R (2012) *Climate change from a criminological perspective*. New York and London: Springer International.
- White R (2013) Technology, environmental harm and green criminology. In McGuire MR and Holt TJ (eds) *The Routledge handbook of technology, crime and justice*: 241–259. London and New York: Routledge.
- White R and Yeates J (2019) Farming and climate change. In Gray A and Hinch R (eds) *A handbook of food crime: Immoral and illegal practices in the food industry and what to do about them*: 315–330. Bristol: Policy Press.
- Whyte D (2014) Regimes of permission and state-corporate crime. *State Crime Journal* 3(2): 237–246. <https://doi.org/10.13169/statecrime.3.2.0237>
- Willig C (2014) Interpretation and Analysis. In Flick U (ed.) *The SAGE Handbook of Qualitative Data Analysis*: 126–138. London: SAGE Publications.
- Wyatt T (2014a) A criminological exploration of the industrialisation of pig farming. *Internet Journal of Criminology* 1(1): 12–28.
- Wyatt T (2014b) Non-human animal abuse and wildlife trade: Harm in the fur and falcon trades. *Society and Animals* 22(2): 194–210. <https://doi.org/10.1163/15685306-12341323>
- Yates R (2007) Debating 'animal rights' online: The movement-counter movement dialectic revisited. In Beirne P and South N (eds) *Issues in green criminology: Confronting harms against environments, humanity and other animals*: 140–157. Abingdon and New York: Willan.