

Environmental and Wildlife Crime in Sweden from 2000 to 2017

Journal of Contemporary Criminal Justice

1–25

© The Author(s) 2020

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/1043986220927123

journals.sagepub.com/home/ccj**Richard Stassen¹ and Vania Ceccato¹**

Abstract

This study combines police records with newspaper articles (media archives) to report the nature and trends of environmental and wildlife crime (EWC) in Sweden from 2000 to 2017. Geographic information systems (GIS) and spatial statistical techniques are used to implement a temporal and spatial analysis of EWC in Swedish municipalities, which are split into three types: urban, accessible rural, and remote rural. Findings show that following the 2006 legal reform that increased possibilities for prosecuting EWC, the number of both police-recorded cases and newspaper articles increased and eventually stabilized. They also show that although the majority of EWCs are minor crimes, particularly in urban municipalities, many of the more serious crimes show chronic temporal and spatial patterns in more rural and remote areas. The persistence of certain serious crimes over time is interpreted as an indication that the costs of breaking environmental law are low relative to economic gains. Then, drawing from criminological theory, the article finishes by discussing implications to research and policy.

Keywords

environmental damage, green criminology, GIS, cluster analysis, media, Scandinavia

Introduction

Environment and wildlife crime (EWC) constitutes a broad category of offenses with no strict definition. For the purpose of this study, EWC is defined as those offenses formally criminalized in Sweden's penal code, varying in scope and severity from minor instances of littering and waste burning, to severe cases of poaching

¹Department of Urban Planning and Environment, KTH Royal Institute of Technology, Stockholm, Sweden

Corresponding Author:

Vania Ceccato, Department of Urban Planning and Environment, School of Architecture and the Built Environment, KTH Royal Institute of Technology, Teknikringen 10A, Stockholm 10044, Sweden.

Email: vania.ceccato@abe.kth.se

and industrial chemical spills (Appendix 1). On average, the Swedish police record around 5,000 EWCs each year (or about 50 per 100,000 inhabitants), whereas national newspapers print around 200 articles about offenses. In Sweden, as well as more broadly, research on the nature and trends of EWC has been a neglected area (Lynch et al., 2013; White, 2008). Lynch et al. (2017), for instance, have argued that a lack of quantitative methodology in green criminology has limited the generalizability of many studies, and restricted the potential for dialogue with more orthodox criminological research.

One possible explanation for this paucity of quantitative analyses could be the lack of reliable official data. EWC is by its nature difficult to detect because it often occurs “out of plain sight.” For example, research in Sweden has found that EWC tends to be reported close to roadways, where it is more likely to be detected by people engaged in routine activities (Ceccato & Uittenbogaard, 2013). Official records thus tend to miss the true magnitude of EWC because detection often depends on citizen reporting and routine inspections, neither of which are likely to detect crimes that occur in more remote areas (but see Ferrara, 2012, for a look at newer aerial surveillance technologies that could be applied to EWC detection). Official police records of EWC may, therefore, be more reflective of the practices and policies that facilitate detection of EWC, rather than reflecting the true pattern of these crimes. In light of this, qualitative methods such as case studies may be appealing, offering holistic views of specific crimes when data sets capturing the full scope of EWC may be unavailable. An alternative is to supplement quantitative data sets with qualitative elements—although this does not overcome the limitations in official EWC records, it can offer insight into the nature of EWC, which can inform interpretations of quantitative data.

The aim of this study is to report the nature and trends of EWC in Sweden from 2000 to 2017. This study builds on previous research of EWC in Sweden, in particular Ceccato and Uittenbogaard (2013), and combines two data sets—one quantitative and one qualitative—each providing complementary perspectives on the nature of Swedish EWC. To achieve this, police crime records are analyzed for spatial–temporal trends, and geographic information systems (GIS) and spatial cluster techniques are used to create maps of high and low concentrations of EWC, over time. This high-level analysis is then supplemented by a media analysis of print newspaper archives, which provides deeper insight into the specificities of EWC in these areas, and allows inferences into the causes of chronic EWC hot spots.

EWC in the Swedish context is interesting for several reasons. Sweden and other Scandinavian countries have a long tradition of dealing with environmental issues, and of serving as models for other countries worldwide, which makes them an interesting case from an international perspective. Moreover, theories and examples from North America and the United Kingdom dominate the international literature on crimes against nature and wildlife (e.g., Adler & Lord, 1991; Cochran et al., 2018; Lynch et al., 2020; Pendleton, 1997; Thomson et al., 2020; Wellsmith, 2011; White, 2013). Finally, spatial–temporal analyses of EWC are rare, and so the results we present are of immediate relevance to Swedish policy makers.

The article is structured as follows: the “Environmental and Wildlife Crimes: Nature and Patterns” section establishes the theoretical framework and describes the research aim. Next, “Framing the Study Area” introduces Sweden as the study area, and “Data and Method” describes data and methodology. Then, results are reported in the section “Results: EWC Trends in Sweden,” which are discussed in “Discussion of Results.” Finally, conclusions, policy implications, and research recommendations are suggested in “Conclusions and Recommendations.”

Environmental and Wildlife Crime (EWC): Nature and Patterns

Mechanisms of EWC

EWCs can be classified in various ways. For example, White (2008) classified them by type of harm, where primary crimes involve direct degradation of the earth’s resources (e.g., deforestation), whereas secondary crimes involve flouting rules that seek to regulate environmental damage (e.g., waste dumping). Alternatively, EWCs can be classified according to how they are perceived, for example, brown (urban) versus green (natural environment) issues.

The motivations behind EWC can vary depending on the type of crime, and the context in which it is committed. Most commonly, EWC in Sweden is the result of negligence (BRÅ, 2006), as would be the case for relatively minor crimes such as improper chemical storage, or more major ones such as accidental oil spills. However, in many instances, EWC can result from deliberate cost-cutting behavior—on the level of the individual, this can motivate petty crimes such as littering or waste burning, or more serious ones such as poaching (Lemieux & Clarke, 2009), whereas on the organizational level, it can motivate systematic dumping of industrial waste (Ceccato & Uittenbogaard, 2013). These crimes exhibit different geographies, and sometimes show persistent temporal and spatial patterns that are reflective of local economic activities.

This study draws upon established criminological theories to inform our understanding of temporal and spatial patterns of EWC: First, the theory around “techniques of neutralization” provides insight into how individuals and organizations justify the decision to commit crimes (Schoultz & Flyghed, 2016; Sykes & Matza, 1957; Whyte, 2016); and second, rational choice theory, which suggests that crimes are committed when the benefits to the perpetrator outweigh the costs (Becker, 1968; Bulgurcu et al., 2010; Justus et al., 2018). Sykes and Matza (1957) describe techniques of neutralization by which people rationalize criminal behavior, some of which are relevant here. For example, these rationalizations could allow the perpetrator of an EWC to (a) deny responsibility by shifting blame to another party, (b) deny injury by arguing that their actions caused no substantive harm to the environment, (c) deny the presence of a victim by claiming that their behavior does not hurt anyone, and (d) appeal to higher loyalties, arguing that their criminal actions, although illegal, were justified for the greater good—for example, an offender might disregard hunting restrictions because

they believe the government should not impose on individual freedoms. Past studies have shown that perpetrators of different types of crimes often rely on different rationalization techniques—for example, Siponen et al. (2012) found (d) the appeal to higher loyalties to be a strong predictor of digital piracy, whereas Li and Cheng (2013) found all but (a) denial of responsibility to be relevant motivators for workplace internet abuse (i.e., personal internet use at work).

Rational choice theory can also provide a powerful lens for examining the motivation behind EWC, as it assumes that criminals are rational actors who behave according to cost-benefit analyses (Becker, 1968). From this perspective, the “reward” for committing an EWC is offset by the cost (i.e., the risk of getting caught and punitive severity). This view was discussed by Dahlberg (2016), who argued that the fines for environmental crimes are negligible for firms, who regard it as a cost of doing business. Conversely though, Shimshack and Ward (2005) concluded that fines on American pulp/paper manufacturers produce “a surprisingly large decrease in violation rates, on the order of about a two-thirds reduction” (p.538). This suggests that penalty structures need to be calibrated correctly if they are to effectively disincentivize firms from dumping industrial waste as part of common practice.

Routine activity theory can provide further insight into why EWC may be regarded as a rational choice on the level of the individual. It suggests that the factors that determine whether a person commits an EWC are not intrinsic to the perpetrator, but arise from circumstantial factors: the presence of a potential victim, of a likely perpetrator, and the absence of a guardian (Cohen & Felson, 1979). EWC will, therefore, occur when the conditions are such that the benefits of committing a crime outweigh the cost, suggesting that a lack of surveillance in remote areas should be a crucial element influencing where EWC occurs—a lack of guardianship reduces the chance of getting caught, and so the expected outcome for the perpetrator is improved. This is corroborated by Ceccato and Uittenbogaard (2013) who examined where garbage dumping tends to occur, noting the large concentration around highways in Sweden. They highlight that this may also be reflective of patterns of detection, as crimes are more likely to be noticed in populated areas.

Police Records and Newspaper Articles on EWC

Many crimes against nature go undetected. Others, if detected, may not be reported to the authorities, and a fraction of them attract attention by local newspapers. Nevertheless, the potential of using media coverage as a reference for crimes that suffer from high underreporting rates is not new, as they can be reflective of public discourse and can be indicative of fear of crime.

Davis (1952) produced a seminal study using media archives, showing that the volume of newspaper articles pertaining to crime varied independently of actual crime levels. Other studies show that newspaper articles might underreport some types of events, and overestimate others (Fine et al., 1998; Ghaffar et al., 2001; Marsh, 1991). Previous researchers have also reported that newspaper articles were informative in providing a benchmark for the analysis of police-recorded trends

over time. Sheley and Ashkins (1981), for instance, showed that newspaper presentation of the relative distribution of crimes approximates police figures more closely than does the television presentation, but even so, Reis (1999) showed that the media coverage is not impartial and tends to favor particular topics, sources, and opinions over others.

Spatial Patterns of Crime

Detecting spatial patterns of crime is critical for understanding its causes, and identifying ways to prevent it. Measures of spatial associations have long been applied to the study of crime (Chakravorty, 1995; Sherman, 1995; Weisburd, 2018; Weisburd et al., 2009), but typically for violent and property crimes, and not very frequently for EWC. Although some studies do implement spatial analyses of EWC, they tend to focus on specific crimes such as poaching (Rashidi et al., 2015; Shaffer & Bishop, 2016) or illegal waste dumping (Biotto et al., 2009; Ferrara, 2012; Jordá-Borrell et al., 2014; Notarnicola et al., 2004).

The Getis–Ord statistic (G_i) has a number of attributes that make it attractive for measuring association in a spatially distributed variable such as EWC by municipality (Ceccato & Persson, 2002), most notably that it is able to detect local pockets of dependence that may not show up using global statistics (Getis & Ord, 2010). G_i takes the central locations of municipalities in Sweden as its reference (centroid) and tests whether EWC rates are similar across municipalities, against the null hypothesis that no spatial association exists. The purpose of G_i , here, is to identify robust clusters of EWC. If these hot spots persist over time, it may indicate the presence of conditions that are generative of EWC, or at least facilitate its detection. Although this study updates the findings of Ceccato and Uittenbogaard (2013), we also develop their methodology further by introducing a temporal element in the geospatial analysis. Drawing on criminological theory, we expect geographical patterns to be largely stable over time, as EWC will tend to occur where conditions allow, and these conditions are likely themselves stable characteristics of regions.

EWC in the Swedish Context

In Sweden, research on EWC is fairly new and highly fragmented. For example, Korsell (2001) and Sahramäki et al. (2015) both report on regulatory strategies and practices, Von Essen et al. (2015) and Von Essen and Allen (2017) discuss psychosocial factors that motivate poaching, whereas Ceccato and Uittenbogaard (2013) examine the spatial dimension of EWC. EWCs are punishable by fines or imprisonment, depending on severity, and on whether they are intentional or result from negligence. However, although around 5,000 cases are reported to the police each year, very few are successfully prosecuted. For example, in 2004, there were 3,509 reported EWCs, but only 267 were indicted (7.6%), 177 were prosecuted in court (5.0%), and 107 received judgment (3.0%)—none of these cases resulted in jail time, but suspensions and fines were administered (BRÅ, 2006). Similarly, Du Rées (2001) found that

between 1990 and 1998, only 12% of reported violations of the Environmental Protection Act were indicted. (It should also be noted that this is not a problem limited to Sweden; e.g., see Wellsmith, 2011, and Cochran et al., 2018.)

An EU-level policy change in the mid-2000s removed a requirement for prosecutors to prove that an EWC caused direct physical harm or threat thereof, which improved possibilities for prosecution (Ceccato & Uittenbogaard, 2013), but the actual number of cleared cases has changed little, and has in fact been decreasing (Dahlberg, 2016). Moreover, it is likely that the number of EWCs is highly underreported, and there are several factors that could contribute to this. The size of police jurisdictions, which can vary widely in Sweden, can significantly affect detection rate (Statens Offentliga Utredningar, 2002)—southern municipalities tend to be smaller and more densely populated, and are, therefore, easier to monitor, whereas in northern regions, the police must cover large areas that may be sparsely populated.

A 2006 analysis by the Swedish National Council for Crime Prevention (Brottsförebyggande rådet, abbreviated as BRÅ) also indicated that the police play a relatively small role in EWC detection, with a network of other actors—local environmental offices, chemical inspectors, the coast guard, the public, customs agencies, and general physicians—instead fulfilling this function (BRÅ, 2006). However, these parties either have other responsibilities, or they focus on only a subset of EWC (e.g., chemical inspectors); no authority is actively looking for environmental crimes to any appreciable extent, and so only the most obvious and visible instances tend to be detected (Ceccato & Uittenbogaard, 2013). Due to the scant resources committed to EWC detection and prosecution, prosecutors will tend to focus only on cases that, from experience, they know to be easier to prosecute (BRÅ, 2006). Moreover, Karlsson and Norinder (2012) indicated that there is a relationship between the numbers of environmental inspectors and reported crimes in Sweden. Their model found that the number of inspectors has a positive and statistically significant impact on the number of reported environmental crimes, suggesting that additional investment into inspection may have a meaningful impact on EWC detection.

The lack of empirical EWC research makes it difficult to identify potential mechanisms that can help explain the perpetration of EWC. Taking all this together, in the next section, we suggest a tentative conceptual model for EWC in Sweden.

A Tentative Conceptual Framework for EWC in Sweden

Using two independent data sources (police statistics and newspapers articles), we expect to obtain a better vantage for reporting temporal and spatial trends in EWC.

Based on the theory around techniques of neutralization, we expect that there are overlapping motivations for EWC commission. Perpetrators can engage in denial of injury to nature, as well as denial of the victim, as the natural environment can be perceived as distant and abstract, and so an EWC may seem like a “victimless crime.” In addition, the appeal to higher loyalties can offer an explanation as to why large organizations break the law by damaging the natural environment. For example, corporations might argue that they create jobs for the community, and so their activities

are ultimately for the public good. Each of these techniques of neutralization have been documented as rationalizations for lenient prosecution on the part of Swedish regulatory agencies (Du Réés, 2001).

These mechanisms are superimposed on the notion that individuals and organizations that perpetrate crimes are rational actors who behave according to cost–benefit principles. This means that the cost of breaking the law (damaging nature) is internalized as a “cost of doing business.” We expect that this reasoning would be useful for explaining the location of EWC hot spots in areas that show chronic patterns of EWC, over long periods. In these cases, the “reward” for committing an EWC would not be offset by the cost because the risk of getting caught and punitive severity are both low.

Finally, EWC does not happen at random, but follows people’s routine activity patterns. Thus, isolation and remoteness make some rural areas vulnerable to EWC because of the lack of guardianship and the greater opportunities for crime.

Framing the Study Area

Sweden is one of the largest countries in Europe by area, with 86% of its 10 million inhabitants classified as urban dwelling by the World Bank (2018). It is divided into 21 counties and 290 municipalities, the latter of which are the unit of analysis for this study. These municipalities vary widely both in area (largest is Kiruna at around 21,000 km², smallest Sundbyberg at about 9 km²) and population (largest Stockholm at around 950,000, smallest Bjurholm at around 2,500; Statistics Sweden, 2017). In this study, municipalities are classified by level of urbanization, which is important given the specific nature of EWC. Crime is typically considered to be an urban phenomenon, but EWC differs, in that, certain types—such as illegal predator hunting or industrial waste dumping—are less likely to occur in urban areas (UAs) as there are fewer opportunities for commission (Ceccato & Uittenbogaard, 2013). Large urban populations are nevertheless likely to produce a greater number of crimes overall, but the composition of urban EWC is likely to be different as the density may lead to increased detection of minor crimes such as littering, and it is, therefore, necessary to account for the urban–rural dimension in this analysis. We classify Swedish municipalities according to the following criteria established by the Swedish Council of National Rural Development, which considers both population and accessibility (Figure 1):

- Remote rural (RR) municipalities are those more than a 45-min drive from the nearest urban municipality (i.e., municipalities with more than 3,000 inhabitants), as well as municipalities with no direct land connection.
- Accessible rural (AR) municipalities are those between 5 and 45 min by car from an urban municipality.
- Urban areas (UAs) are municipalities with more than 3,000 inhabitants, as well as those that are within a 5-min drive from these municipalities (SNRDA, 2005).

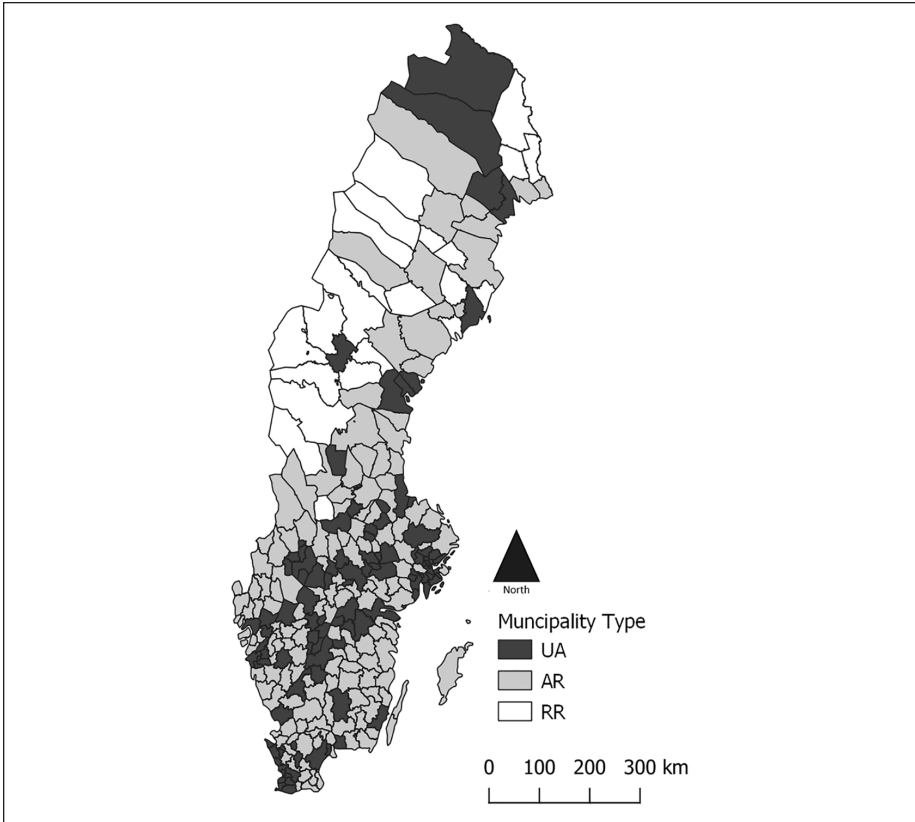


Figure 1. Swedish municipalities by type.

Note. UA = urban area; AR = accessible rural; RR = remote rural.

Of the 290 municipalities in the country, 112 are classified as UA (total population approx. 7 million), 156 as AR (total population approx. 3 million), and 22 as RR (total population approx. 140,000).

Data and Method

Data: Official Police Records and Newspaper Articles

This study employs entirely open data—Swedish crime records are provided online by BRÅ, and newspaper records are accessible from publicly available archives (details below). In addition, GIS-compatible map files were acquired from the Swedish land registration authority (*Landmäteriet*), including the municipal boundary shapefile.

Official police records. For this study, we used police records of EWC in Sweden from 2000 to 2017, broken down by year, municipality (of which there are 290), and by crime type (see Appendix 1 for a listing of EWC-related crime codes). There were 112,953 records in total, with an average of about 6,275 EWCs each year. However, all hunting violations (code 4011; “*jaktlagen*,” in Swedish) had to be excluded due to data quality issues, resulting in an average of 5,317 EWCs each year. This exclusion is detailed in “Temporal Patterns in Police EWC Records” section.

The police EWC records were categorized by crime type, and by the remoteness of the municipality in which they occurred. EWCs were grouped into the same classes used by Ceccato and Uittenbogaard (2013):

- *Serious* crimes involved large-scale contamination of air, water, or soil, usually from leaking oil or other chemicals.
- *Chemical* crimes involved violation of chemical use/storage regulations. This includes unsafe storage of dangerous chemicals, improper safety practices, or use of chemicals without permission (e.g., illegal pesticide use).
- *Nature and wildlife* crimes involved the violation of hunting/fishing regulations, direct harm to animals, or the physical destruction of habitats.
- *Minor* crimes were small-scale infractions such as littering, or waste burning.

Finally, the data were aggregated according to the above classification scheme, allowing examination of EWC patterns in space and time, by crime type.

Newspaper articles. Newspaper reports on EWCs were gathered from two sources: First, this study builds upon the newspaper article counts reported by Ceccato and Uittenbogaard (2013) for the years 2000 to 2011. Second, we expanded upon this data set by searching Swedish news archives for print articles published between 2012 and 2017. This open database allows users to enter a search term and will return any article published in any Swedish newspaper containing the term, within a specified time frame. To remain methodologically consistent with Ceccato and Uittenbogaard (2013), we employed the same keywords in our database search: “environmental crime” in combination with (AND) “pollution,” “leakage,” “emissions,” “chemicals,” “chemical handling,” “fish,” “animal,” “hunt,” “burning,” and “environmental impact.” Note, these are translations of the original Swedish search terms, respectively: “*miljöbrott*” AND “*förorening*,” “*läckage*,” “*utsläpp*,” “*kemikalier*,” “*kemikalihantering*,” “*fisk*,” “*djur*,” “*jakt*,” “*eldning*,” and “*miljöpåverkan*.” This yielded a raw data set of approximately 2,400 articles that had to be manually scanned and sorted. Because our aim was to map newspaper articles, they were each checked for content to ensure they referred to an EWC that had actually occurred in Sweden. Articles dealing with international cases, crime statistics, or those about changes in EWC law were excluded, as these could not be geolocated within our study area. Similarly, the raw data set contained duplicates where identical articles were published in multiple local papers, and in these cases, articles were excluded. (However, when the same crime was the subject of multiple articles, each with unique headlines and authors, then each article was kept, as were articles that reported

on the legal proceedings around more high-profile crimes.) More than half of the articles were removed in this process, resulting in a final data set of 1,095 newspaper articles reporting on EWCs that had occurred in Sweden between 2012 and 2017 (average of 183 articles per year). In comparison, Ceccato and Uittenbogaard (2013) analyzed 1,241 EWC articles between 2000 and 2011, with an average of 103 per year.

We briefly summarized the content of each article and recorded the municipality in which the referenced crime occurred. Newspaper-reported EWCs were also sorted by crime type, into the same categories as police records. This step opens the possibility of human bias, as crime code is rarely indicated in newspaper articles and so crime type had to be interpreted. As much as possible, we attempted to apply consistent categorization practices according to the criteria outlined above. Note, however, that the proper classification of a crime is often a matter of degree. Improper chemical storage can become a serious crime if a sufficient volume of chemicals leaks into the soil. Similarly, waste burning is of minor significance at the level of an individual, but large emissions can result from industrial waste burning, and such cases should be classified as serious EWC.

Following the sorting, newspaper articles were aggregated by municipality, resulting in a final data set of 290 municipalities, with the number of newspaper-reported EWCs that occurred in each, between 2012 and 2017, broken down by crime type.

Method

The methodology for this study is divided into three separate components: (a) We looked at police-recorded EWC data to evaluate how the composition of reported crimes varied according to level of urbanization; (b) we assessed both data sets for temporal and spatial trends, and determined whether correlation exists along these dimensions; and (c) in the final phase of our analysis, we used the police records to implement a hot spot analysis to identify municipalities with consistently high levels of EWC. In components (b) and (c), we used newspaper articles to add a qualitative dimension to our analysis, providing insight into the nature and causes of higher level patterns observed in the data.

EWC composition by municipality type. Each item in the police record was grouped into one of the aforementioned EWC categories and attributed to the municipality in which it occurred. Three pie charts were produced, depicting the composition of EWC in each municipality type (UA, AR, RR).

Spatial and temporal trends in police-reported EWC and newspaper articles. The temporal trends in EWC reports from both sources were depicted in a line-bar chart. The temporal relationship between these trends was visually assessed, and further supported by Pearson correlation coefficients.

The spatial patterns were visualized in two maps—one for police records and one for newspaper articles. Each map depicts the 290 Swedish municipalities with shading

to indicate the number of events that occurred in each. Whereas the map of police-reported EWCs reflects the events that occurred throughout the entire sample period (2000–2017), the map of EWCs that were reported in newspapers uses a sample of 2 years—2012 and 2017—as the process of geolocating referent articles proved excessively time consuming.

One complication arose when mapping newspaper-reported EWCs because some articles referenced crimes that affected multiple municipalities, and so linking the article to a single municipality would have obscured the spatial pattern. Here, we had a choice to either artificially inflate the number of newspaper articles reporting on EWC by applying the same article to multiple areas, or to artificially intensify their spatial concentration by restricting them to a single municipality. For the purpose of this map only, we chose the former option because the inflation in number of articles was negligible, and we deemed it important to apprehend the spatial distribution.

The relationship between the spatial patterns observed from both data sources was evaluated through visual assessment of maps and, again, through a more robust correlation analysis.

Hot spot analysis of police EWCs. EWC hot spots were located using G_i to identify clusters of municipalities exhibiting high levels of EWC in our sample period. We controlled for municipal population by calculating the ratio of the observed number of police-reported EWCs to the number that should be expected based on the population in each municipality—that is, each municipality’s population multiplied by the national average number of EWCs per person. This gave us the EWC risk:

$$E_i = \frac{\sum_{i=1}^N O_i}{\sum_{i=1}^N P_i} \times P_i \quad (1)$$

$$\text{Risk}_i = \frac{O_i}{E_i} \times 100 \quad (2)$$

where

$N = 290$ (the total number of municipalities in Sweden),

p = municipal population,

O = the observed number of police-recorded EWCs in a municipality,

E = the expected number of police-recorded EWCs in a municipality.

We spatially linked the risk values to each municipality and produced maps highlighting the municipalities for which $O \geq E$. This allowed us to use GeoDa (open source spatial analysis software) to perform a hot spot analysis using local G_i . The local G_i provides a criterion for identifying clusters of high or low values that are statistically significant. When the model provides a measure of spatial clustering that includes the observation $j = i$ under consideration, the model is called G_i^* . The local G_i , G_i^* , is given by the formula

$$G_i^* = \frac{\sum_i w_{ij}(d) x_j}{\sum_k x_k}$$

where $w_{ij}(d)$ are the elements of the contiguity matrix for distance, d ; in this case, a binary spatial matrix was used to incorporate the spatial information entailed in the map of Swedish municipalities. A simple 0/1 matrix was used, where 1 indicates that the municipalities have a common border, and 0, otherwise. The standard normal deviation (z value) was used to indicate significant differences in values. A positive and significant z value indicates spatial clustering of high values, whereas a negative z value indicates spatial clustering of low values (these locations are illustrated in Figure 5).

Results: EWC Trends in Sweden

EWC Composition by Municipality Type

Figure 2 follows up on the results of Ceccato and Uittenbogaard (2013) by portraying the geographic patterns in EWC, and how they differ in urban and nonurban settings. Their findings are mostly supported here, particularly regarding the higher proportion of chemical EWCs reported in RR, compared with AR and UA. However, Figure 2 also offers a correction to Ceccato and Uittenbogaard (2013): hunting code violations, fishing code violations, and illegal predator hunting (crime codes 4011, 4012, and 4031, respectively; see Appendix 1)—three crime categories relevant to their analysis—were mistakenly excluded from their investigation of geographic patterns in police-reported EWCs. Data for fishing violations and illegal predator hunting are now included in this analysis (Figure 2; corrected 2000–2011 values in parentheses), however hunting violations are again excluded due to the aforementioned data quality issue (details in section “Temporal Patterns in Police EWC Records”).

In addition to the increased proportion of chemical EWCs in RR municipalities (24% in RR, compared with 19% in UA and 14% in AR), the results now show greater proportions of nature and wildlife crimes in non-UAs, which makes intuitive sense given the greater opportunities for accessing nature outside of large cities. Nature and wildlife crimes account for about 20% of EWCs in UAs, compared with around 30% in AR and RR areas (Figure 2). Conversely, minor offenses, such as residential waste burning, represent a larger proportion of EWC in more urbanized municipalities (43% UR, 36% AR, and 26% RR), whereas the relative occurrence of serious EWC is about 20%, regardless of urbanity.

Temporal Patterns in Police EWC Records

Figure 3 presents the temporal trends in EWC between 2000 and 2017, from both police records (lines) and newspaper reports (bars). Two notable periods of growth can be seen in the police-recorded EWCs—after 2006 and more recently after 2013—both with different explanations. First, the growth after 2006 is likely due to the implementation of the EU-wide policy changes, resulting in a new system for coding environmental crimes, as well as new practices that improved the possibilities for prosecuting EWCs (Ceccato & Uittenbogaard, 2013).

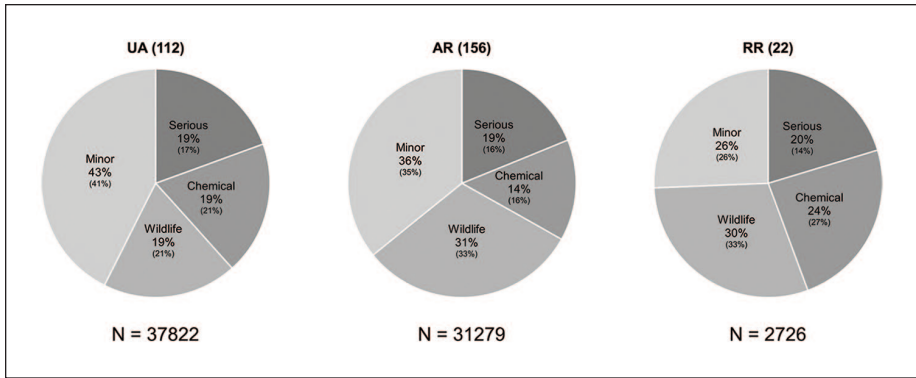


Figure 2. Police-recorded EWC by municipality type, 2000–2017.

Note. Hunting offenses were excluded. Illegal hunting of predators and fishing violations are now included when compared with Ceccato and Uittenbogaard (2013). EWC = environmental and wildlife crime; UA = urban area; AR = accessible rural; RR = remote rural.

The number of EWCs shows indications of stabilization after 2013, but this is not immediately evident because of a data quality issue caused by significant overreporting of EWC. The EWC growth in this period is driven by a 176% increase in the number of reported hunting violations from 2013 to 2016, which upon investigation was found to be the result of procedural errors by the police, who had been incorrectly registering traffic accidents involving wildlife as hunting code violations. This overreporting is visible in Figure 3, in which the EWC trend derived from the raw data is presented as a dotted line. To compensate for this error, hunting violations were removed from the analysis, and the resulting trend is presented as a solid line. The two trends in Figure 3 follow each other closely until around 2013, at which point, the incorrect coding procedure began and there is significant divergence.

The 2017 police EWC counts depicted in Figure 3 show a dramatic decline in EWCs, indicating that this issue has been identified and likely corrected. Looking only at the solid line, which excludes hunting violations, a much flatter trend can be seen after 2007—after removing the misreported crime category, the EWC trend is relatively stable. There does appear to be an increase in reported EWCs after 2010, but data from more recent years show a reduction in reported crimes, returning to around 2007 levels, suggesting that this could be due to natural fluctuations.

Relationship Between Police EWC Records and EWC Media Coverage

Our analysis shows that the number of EWCs recorded by the police and reported by newspapers exhibit a strong positive temporal correlation between 2000 and 2017— $r = .807, p < .010$ —but further insight into the relationship can be garnered through graphical analysis. Figure 3 conveys the temporal relationship between the number of EWCs recorded by the police, and the number of newspaper articles about EWCs in

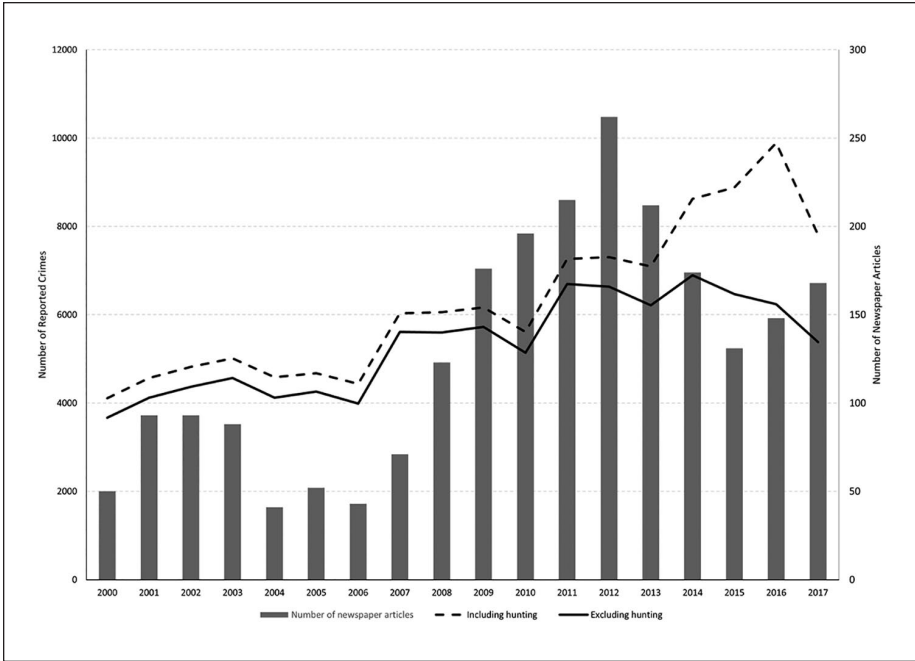


Figure 3. Environmental and wildlife crimes in Sweden, according to police records (dotted and solid lines) and newspaper articles (bars; counts between 2000 and 2017); Article counts from 2000–2011 from Ceccato and Uittenbogaard (2013).

Sweden. In particular, there is a dramatic increase in EWC news articles between 2006 and 2012, of more than 500%. This gives an extended view of the trend observed by Ceccato and Uittenbogaard (2013), who report a 330% increase in the number of EWC articles between 2000 and 2011 (our 2000–2011 data were extracted from that study). However, the extended sample period in this analysis gives further information that was not previously available: EWC news articles and police reports rise in tandem after 2006, but this relationship subsequently weakens as the number of police-recorded cases stabilizes, although EWC news articles continue to rise until 2012, before sharply falling in the years following.

EWC reports from both sources may have risen together after 2006 as environmental issues became mainstream news (i.e., the change in EU EWC law may have prompted, or been a response to increased awareness), but it is unclear why EWC received such pronounced media attention between 2010 and 2013. One explanation could be the occurrence of several high-profile cases in these years. For example, a 2011 oil leak from an Arizona plant in Söderhamn was the subject of numerous articles from 2012 to 2015, as was a massive fish die-off in 2012, after a Findus (subsidiary of Nomad Foods) processing plant caused a large volume of water in the Vege River to become deoxygenated.

Although these cases were severe, they give insight into the types of stories that attract media focus: dramatic incidents that involve clear and immediate damage to local wildlife. Another example of this occurred in 2014, when slaughterhouse waste was spilled into a river, turning it visibly red. This was the subject of more than a dozen newspaper articles, although the damage caused by this incident is likely less severe than that caused by more chronic violations that are often underreported. For instance, an article published in *Västerbottens-Kuriren* (a Swedish newspaper based in Umeå) on December 17, 2012, investigates contamination from seven mines in northern Sweden, finding that “[all] but one exceeded the guideline value,” with emissions of arsenic, zinc, and cadmium that were “far above the Swedish Environmental Protection Agency’s evaluation for what is acutely dangerous for plant and wildlife in lakes and streams.” This was a relatively minor publication (one other article reported on the same mine investigation), but the prevalence of contamination, present in entirely different mines, indicates that it is likely a systemic issue that may cause far greater environmental damage than many acute incidents.

Figure 4 compares the geography of EWC police reports from 2000 to 2017 with news articles in two sample years (2012 and 2017). A weak but statistically significant pattern is visible in the maps, which show that municipalities with more newspaper articles tend to have higher levels of police-recorded EWC ($r = .287, p < .010$), which is consistent with Ceccato and Uittenbogaard (2013), who found a positive correlation between police-recorded EWC and newspaper articles, by municipality, between 2000 and 2011 ($r = .330, p < .010$).

Hot and Cold Spots of EWC

Figure 5 depicts hot spots of each type of EWC in Sweden, and tracks how the patterns changed throughout the periods of EWC growth described in section “Relationship Between Police EWC Records and EWC Media Coverage.” Overall, the maps support the findings presented in Figure 2, namely, that minor crimes show greater prominence in the more heavily urbanized south, whereas other types are more prevalent in rural municipalities in the north (chemical and serious EWCs are grouped here, as the serious crimes are few in number and often involve large-scale chemical contamination). However, the temporal dimension in Figure 5 reveals the additional insight that EWC geography tends to be persistent over time. This is particularly true for serious EWC, but for minor EWC, the hot spots in the south persist, whereas northern hot spots have faded in more recent years. This could be because the 2006 legal reform allowed for increased prosecution of minor offenses in particular—for example, the average annual number of littering charges between 2011 and 2017 is 65% higher than the annual average from 2000 to 2006. Because minor EWCs are more commonly detected in densely populated areas, this would increase the national EWC rate, increasing the expected number of EWC in the north, and would thus reduce the likelihood of identifying a northern hot spot of minor EWC.

The persistence of EWC hot spots over time is likely reflective of the economic activities that predominate each region, as well as the lifestyle options available to

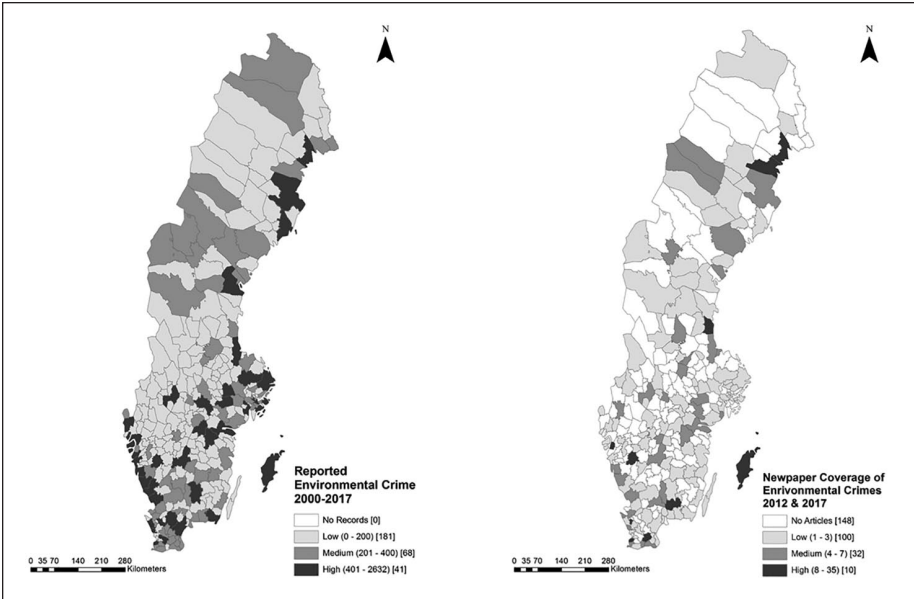


Figure 4. Correlation between newspaper articles and police statistics.

their inhabitants. For example, serious and chemical EWC hot spots are persistent in the remote north, as well as in the southern tip of the country. The northern hot spots are likely attributable to heavy industrial mining activity in the region, and concrete examples of this can be gleaned from media records.

For instance, the small municipality of Sorsele (current population approximately 2,500) has been a hot spot for serious and chemical EWC in each of the time periods sampled, and numerous articles in 2012, 2014, and 2015 reported on water and soil contamination from mines operating nearby. In these cases, EWC was identified through routine environmental inspections, and the contamination does not tend to result from accidental spills, instead resulting from standard mining operations. Conversely, articles in southern municipalities such as Skurup, Sjöbo, and Tomelilla tend to focus on minor offenses and oil spills, either from local manufacturing or from commercial shipping accidents.

Nature and wildlife crime exhibits a different pattern: There are persistent cold spots in the south, and hot spots are visible in the north. Interestingly, there is also a persistent hot spot of nature and wildlife crime in Västra Götaland County. The newspaper archives were of limited usefulness in ascertaining the nature of these crimes, as the large majority are hunting or fishing violations, which do not typically warrant media attention. It is likely, however, that the observed pattern is simply a consequence of where there are opportunities for hunting and fishing, which are limited in the south. Moreover, Swedish law designates permitted hunting zones, and hunting that occurs

outside those areas is necessarily illegal and so spatial patterns in nature and wildlife crime may, therefore, be largely reflective of these boundary designations.

As with serious and chemical EWC, minor crimes tend to be clustered in the remote north and southern tip of the country. The nature of minor EWC in both regions tends to be similar: Frequent news stories report on minor offenses such as garbage burning and illegal disposal of residential/personal waste, often by dumping it in the forest.

Discussion of Results

The results of this analysis are overall consistent with the patterns that should be expected to emerge based on evidence from the international literature; they reveal that EWC does not follow a random pattern, but tends to occur when circumstantial, cultural, and/or economic factors facilitate crime. They also show that the temporal patterns in EWC remain stable throughout our sample period. This suggests that criminogenic conditions might also be static or changing slowly, but it is difficult to be certain about the nature of this process because legal and recording practices significantly influence the detection and prosecution of EWC, as exhibited by the permanent increase in the number of police-recorded incidents after the 2006 legal reform. This point is reiterated by the overreporting of hunting violations that occurred between 2013 and 2016, which may be indicative of poor training procedures on the part of the police, or of ambiguous crime code definition, resulting in uncertainty on the part of officers responsible for reporting incidents. Such oversights might initially appear minor, but can make it difficult to identify robust patterns. As such, the temporal stability we observe may indicate a genuine stability in crime, but may also reflect legal frameworks and practices of recording EWC in Sweden.

Further insights become available as we break down EWC by type, and explore the differences in their spatial distributions; we find that each type of EWC exhibits unique patterns, which are suggestive of their motivations and opportunities for crime. Rational choice theory proves especially instructive for understanding the incentive structures that motivate crime, both in cases of minor EWC perpetrated by individuals and for larger scale corporate crimes. For both, it is useful to consider the internalized cost–benefit analyses by which perpetrators compare a crime’s payoff with the punishment and chance of getting caught. For example, the representation of nature and wildlife EWC is highest in rural areas, which is, in part, due to the fact that opportunities for hunting are more available in those areas, but it also provides insight into the personal cost–benefit analyses of those who violate hunting laws. The remote areas where nature and wildlife EWC tends to occur are characterized by a low degree guardianship, and thus the chance of “getting caught” would appear lower. Perpetrators may, therefore, consider the entertainment value of illegal hunting to be worth the low risk.

Such cost–benefit assessments can be complicated by the consideration of broader cultural trends. For instance, Von Essen et al. (2015) note that the illegal hunting of predators, specifically wolves, has become a form of counterpublic protest in Sweden. In such cases, EWC perpetrators employ a technique of neutralization by “appealing to higher to authorities”—that is, the principle that government should not impose on

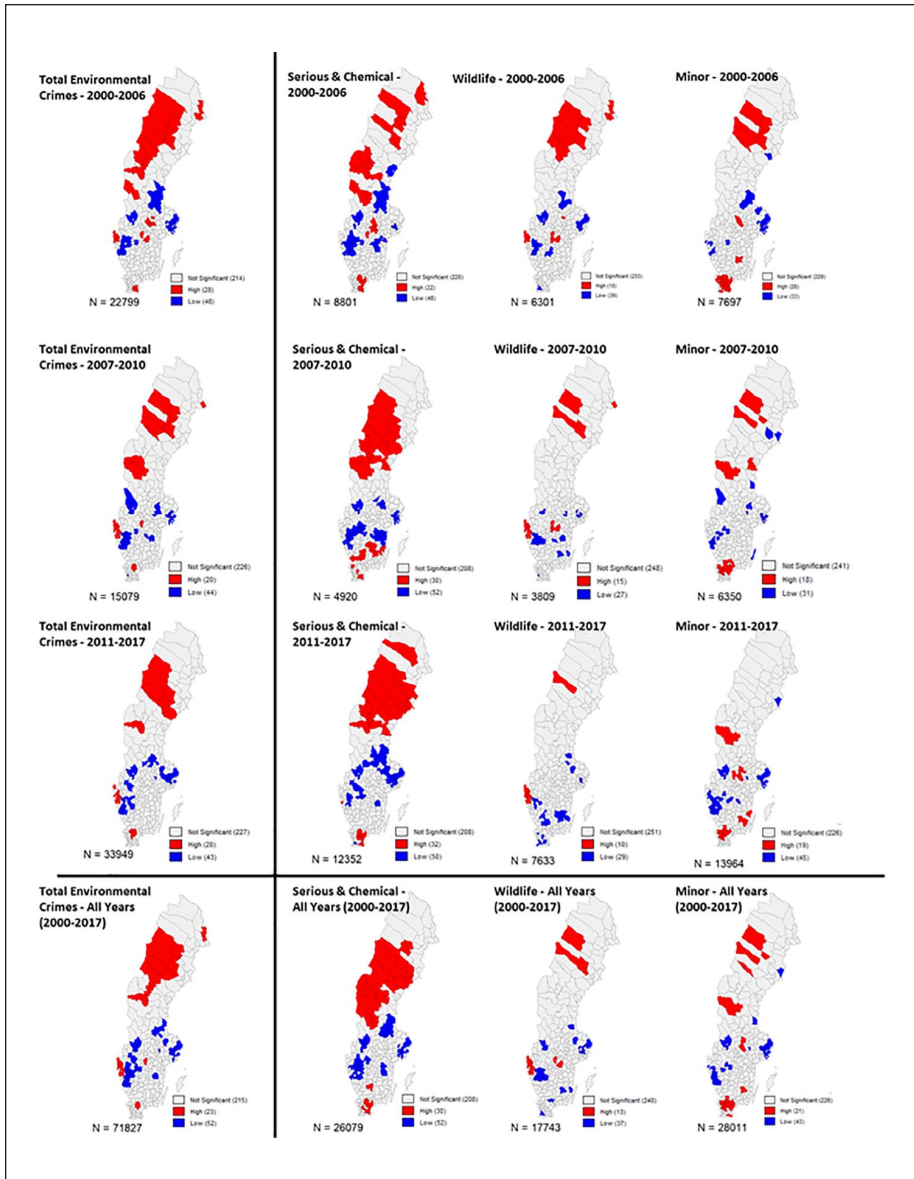


Figure 5. Geography of EWC risk over time (Getis–Ord Statistics; red highlighted areas are clusters of municipalities that exhibit levels of police-reported EWC that are higher than expected).
Note. EWC = environmental and wildlife crime.

individual freedoms. In this case, the fact that predator hunting is illegal may even be seen as a benefit, as it gives perpetrators an opportunity to fulfill political motivations, and to engage in behaviors that are seen as expressions of cultural identity.

Similar factors may also influence the pattern of minor EWC, which are the most common type of EWC in UAs, but which nevertheless exhibit a more distributed pattern, with hot spots present in north, central, and southern Sweden. In particular, the northern hot spots of minor EWC are in remote areas, and likely arise due to the same lack of guardianship that contributes to nature and wildlife crimes in those areas. This does not explain, however, why minor EWC is so prevalent in UAs, and why hot spots exist in the more densely populated south. Cost–benefit analyses are relevant in these areas as well, albeit with smaller stakes. For instance, the reward for burning one’s garbage is nothing more than convenience and the avoidance of disposal fees, although perpetrators risk only minor fines. The prevalence of minor EWC in urban municipalities is likely reflective of the greater population density, which increases the probability of detection as minor crimes might be reported by neighbors or passersby. The fact that minor crimes persist despite the increased risk of punishment may indicate that fines are too lenient to serve as a sufficient disincentive.

Overleniency might seem benign with regard to the punishment of minor EWC, but it may have more severe consequences for serious EWCs, such as industrial environmental contamination. Although the proportion of serious EWC is approximately even in urban versus rural areas, our cluster analysis reveals temporally persistent hot spots in southern and northern Sweden. These likely reflect the geographies of industrial polluters such as, for instance, the food processing plant that caused the aforementioned deoxygenation of the Vege River. The chronic nature of these hot spots, as with the mining industry active in northern Sweden, suggests that punitive measures are not sufficient to prevent repeated offending. In these cases, the fines received for violation of environmental law are a small fraction of their profits, and may be regarded as a “cost of doing business.”

Likewise, techniques of neutralization may offer further insight into why chronic cases of serious EWC persist. For example, mining companies that routinely emit excessive levels of heavy metals in the environment may be able to justify their activities by denying the victim (claiming that no one is harmed by the emissions) or through the appeal to higher loyalties (defending their commercial activities claiming that they are necessary to support the local economy). It is worth highlighting, however, that supervisory agencies are also complicit in this as they are under pressure to maintain good relationships with the companies they regulate, and to support local economic health, and so they employ the same rhetoric to justify their underreporting of EWC (Du Rées, 2001).

Conclusion and Recommendations

The aim of this study was to report the nature and trends of EWC in Sweden from 2000 to 2017. This was achieved through the analysis of two distinct datasets—police EWC records and print newspaper archives. Both data sets were evaluated temporally and

spatially, and their correlation was assessed across both dimensions. Finally, we closely inspected the EWC hot spots identified in the police data by examining the EWC coverage in local newspapers. This revealed specificities of EWC cases in those regions, which provided insight into what micro-level motivations can explain macro-level patterns.

These findings are directly applicable toward policy in Sweden, but this study also offers a methodological contribution that is more broadly relevant. EWC is notoriously difficult to regulate because it often occurs in remote areas that are difficult to monitor, and so crimes in rural settings are often only detectable by chance. Even in UAs, EWCs may be regarded as victimless, and do not tend to be prioritized by law enforcement, who are disincentivized from committing resources to the regulation of crimes that are difficult to clear or to prosecute.

It is, therefore, likely that EWC is vastly underreported, suggesting that police EWC data may not adequately express the total levels of crime. The inclusion of newspaper articles in this analysis enriches our data, providing a more holistic perspective on EWC, and the use of an independent data source serves as a benchmark for comparison with police statistics. The quantitative and qualitative aspects of these data sets complement each other, as the statistical analysis reveals high-level trends and patterns that are not discernible when dealing with individual cases, and the media analysis gives insight into public perception and shifting cultural attitudes, which influence police priorities, and ultimately the detection and prosecution of EWC. Our analysis also finds a correlation between the number of EWCs recorded by the police, and the number reported in newspapers, both temporally and spatially, suggesting a degree of mutual influence between the two. However, it must be stressed that newspaper analysis is limited by the scope of media attention, which tends to report on provocative issues that will boost readership. Future research should mitigate this by seeking to employ better quality news media data by concentrating on newspaper articles that relate to crime detection only. This demands an in-depth analysis of articles and their classification by type. For instance, those articles that directly relate to crime detection/commission should be prioritized over secondary articles that focus, for example, on criminal court proceedings.

Despite these limitations, this study advances our understanding of the patterns of EWC in Sweden, which is an important step toward its successful regulation. On one hand, some of the minor illegal activities are overreported because they are easy to detect, whereas other, more serious offenses have become normalized by a culture attempting to balance conflicting interests under the current discourse of economic and environmental sustainability—that is, the need to keep local jobs versus the cost of environmental harm. Chronic cases of EWC are rarely reported in the news but have for decades been incorporated as a “cost of doing business.” To better understand these problems, future research should focus on areas with chronic cases of serious EWC, both through qualitative and quantitative analyses. We would echo Lynch et al. (2017) in calling for further quantitative analyses of EWC. In the Swedish context, the key municipalities we have identified here should be the subjects of statistical-econometric analyses focused on understanding the causal factors behind EWC, as this would be crucial to the development of effective preventive policy. Further, case studies that engage perpetrators, environmental inspectors, and policy makers have potential to

reveal details of the crime structure, regarding both the motivations and opportunities for crime. They can also better confirm the existence of external mechanisms that allow EWC to occur in particular spatial and temporal contexts. Studies of this kind would better contribute to the development of the theoretical framework by which we have interpreted EWC in this study.

Appendix I. List of Swedish EWC Codes.

| Penal code | Description (Swedish) | Translation | Category |
|------------|--|---|------------------------------------|
| 8001 | Förorening av mark, vatten, luft m.m. | Contamination of soil, water, air, etc. | Serious crimes against nature |
| 8002 | Vållande till miljöstörning | Disturbing natural habitats | Destruction of nature and wildlife |
| 8003 | Miljöfarlig kemikaliehantering | Environmentally hazardous chemical handling | Unlawful handling of chemicals |
| 8004 | Avsaknad av tillstånd | Use of chemicals without permission | Unlawful handling of chemicals |
| 8005 | Brytande av villkor | Breach of handling procedure | Unlawful handling of chemicals |
| 8006 | Försvårande av miljökontroll | Aggravating environmental control | Unlawful handling of chemicals |
| 8007 | Bristfällig miljöinformation | Inadequate records of chemical use | Unlawful handling of chemicals |
| 8008 | Nedskräpning | Littering | Minor crimes and others |
| 8009, 8016 | Brott mot naturvård och artskydd | Violation of conservation and species protection | Destruction of nature and wildlife |
| 8010 | Brott mot miljöskydd och vattenverksamhet | Violation of environmental protection and water activities | Destruction of nature and wildlife |
| 8011 | Spridning av bekämpningsmedel m.m. | Illegal spreading of pesticides, etc. | Unlawful handling of chemicals |
| 8012 | Förbud mot djurhållning m.m. | Illegal animal husbandry | Destruction of nature and wildlife |
| 8013 | Obehörig befattning med djur eller växtart etc. | Illegal possession of animals (exotic) | Destruction of nature and wildlife |
| 8014 | Förorening från fartyg | Leakage from ships | Serious crimes against nature |
| 8015 | Brott eller förseelse mot områdesskydd | Damage to protected areas | Destruction of nature and wildlife |
| 8017 | Övriga brott mot miljöbalken | Other violations of environmental code | Minor crimes and others |
| 8018 | Otillåten nationell avfallstransport | Unauthorized national waste transport | Minor crimes and others |
| 8019 | Otillåten gränsöverskridande (inom, till och från EU) avfallstransport | Unauthorized cross-border (within, to, and from the EU) waste transport | Minor crimes and others |
| 4031 | Illegal rovdjursjakt | Illegal predator hunting | Destruction of nature and wildlife |
| 4011 | Övriga brott mot jaktlagen | Other violations of the Hunting Act | Destruction of nature and wildlife |
| 4012 | Brott mot fiskelagen | Violations of the Fisheries Act | Destruction of nature and wildlife |

Source. BRÅ (2006).

Note. EU = European Union.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was partially funded by FORMAS—Forskningsrådet för miljö, areella näringar och samhällsbyggande (A Swedish Research Council for Sustainable Development), Grant number 2016-01424.

References

- Adler, R. W., & Lord, C. (1991). Environmental crimes: Raising the stakes. *George Washington Law Review*, 59, 781–790.
- Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy*, 76, Article 169.
- Biotto, G., Silvestri, S., Gobbo, L., Furlan, E., Valenti, S., & Rosselli, R. (2009). GIS, multi-criteria and multi-factor spatial analysis for the probability assessment of the existence of illegal landfills. *International Journal of Geographical Information Science*, 23, 1233–1244.
- BRÅ. (2006). *Är vi bra på miljöbrott? En snabbanalys* [Are we good at environmental crimes? A quick scan] [Online]. www.bra.se
- Bulgurcu, B., Cavusoglu, H., & Benbasat, I. (2010). Information security policy compliance: An empirical study of rationality-based beliefs and information security awareness. *Management Information Systems Quarterly*, 34, 523–548.
- Ceccato, V., & Persson, L. O. (2002). Dynamics of rural areas: An assessment of clusters of employment in Sweden. *Journal of Rural Studies*, 18, 49–63.
- Ceccato, V., & Uittenbogaard, A. (2013). Environmental and wildlife crime in Sweden. *International Journal of Rural Criminology*, 2, 25–52.
- Chakravorty, S. (1995). Identifying crime clusters: The spatial principles. *Middle States Geographer*, 28, 53–58.
- Cochran, J. C., Lynch, M. J., Toman, E. L., & Shields, R. T. (2018). Court sentencing patterns for environmental crimes: Is there a “green” gap in punishment? *Journal of Quantitative Criminology*, 34, 37–66.
- Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review*, 588–608.
- Dahlberg, J. (2016). *Miljöbrott: Omfattning och utredning i Sverige* [Environmental Crime: Extent and Investigation in Sweden]. Karlstads Universitet.
- Davis, F. J. (1952). Crime news in Colorado newspapers. *American Journal of Sociology*, 57, 325–330.
- Du Rées, H. (2001). Can criminal law protect the environment? *Journal of Scandinavian Studies in Criminology and Crime Prevention*, 2, 109–126.
- Ferrara, C. (2012). Illegal dumping investigation: A new challenge for forensic environmental engineering. *WIT Transactions on Ecology and the Environment*, 163, 3–11.
- Fine, P. R., Jones, C. S., Wrigley, J. M., Richards, J. S., & Rousculp, M. D. (1998). Are newspapers a viable source for intentional injury surveillance data? *Southern Medical Journal*, 91, 234–242.

- Getis, A., & Ord, J. K. (2010). The analysis of spatial association by use of distance statistics *Perspectives on Spatial Data Analysis*, 24, 189–206.
- Ghaffar, A., Hyder, A. A., & Bishai, D. (2001). Newspaper reports as a source for injury data in developing countries. *Health Policy and Planning*, 16, 322–325.
- Jordá-Borrell, R., Ruiz-Rodríguez, F., & Lucendo-Monedero, Á. L. (2014). Factor analysis and geographic information system for determining probability areas of presence of illegal landfills. *Ecological Indicators*, 37, 151–160.
- Justus, M., Ceccato, V., Moreira, G. C., & Kahn, T. (2018). Crime against trading: The case of cargo theft in Sao Paulo. In V. Ceccato & R. Armitage (Eds.), *Retail crime* (pp. 305–335). Springer.
- Karlsson, J., & Norinder, M. (2012). *Påverkas antalet anmälda miljöbrott i Sverige av antalet miljöinspektörer?* [Is the number of reported environmental violations in Sweden affected by the number of environmental inspectors?]. Göteborgs universitetsbibliotek.
- Korsell, L. E. (2001). Big stick, little stick: Strategies for controlling and combating environmental crime. *Journal of Scandinavian Studies in Criminology and Crime Prevention*, 2, 127–148.
- Lemieux, A. M., & Clarke, R. V. (2009). The international ban on ivory sales and its effects on elephant poaching in Africa. *The British Journal of Criminology*, 49, 451–471.
- Li, W., & Cheng, L. (2013). Effects of neutralization techniques and rational choice theory on Internet abuse in the workplace. In *PAICSACIS 2013 Proceedings* (p. 169). <https://aisel.aisnet.org/paics2013/169>
- Lynch, M. J., Barrett, K. L., Stretesky, P. B., & Long, M. A. (2017). The neglect of quantitative research in green criminology and its consequences. *Critical Criminology*, 25, 183–198.
- Lynch, M. J., Long, M. A., Barrett, K. L., & Stretesky, P. B. (2013). Is it a crime to produce ecological disorganization? Why green criminology and political economy matter in the analysis of global ecological harms. *The British Journal of Criminology*, 53, 997–1016.
- Lynch, M. J., Long, M. A., & Stretesky, P. B. (2020). Geographic variations in, and correlates of green/environmental crime across US states: A preliminary assessment. In K. M. Lersch & J. Chakraborty (Eds.), *Geographies of behavioural health, crime, and disorder: The intersection of social problems and place* (pp. 105–134). Springer.
- Marsh, H. L. (1991). A comparative analysis of crime coverage in newspapers in the United States and other countries from 1960–1989: A review of the literature. *Journal of Criminal Justice*, 19, 67–79.
- Notarnicola, C., Angiulli, M., & Giasi, C. (2004, September 8–12). *Southern Italy illegal dumps detection based on spectral analysis of remotely sensed data and land—Cover maps*. Proceedings of 10th International Symposium on Remote Sensing, Barcelona, Spain.
- Pendleton, M. R. (1997). Beyond the threshold: The criminalization of logging. *Society & Natural Resources*, 10, 181–193.
- Rashidi, P., Wang, T., Skidmore, A., Vrieling, A., Darvishzadeh, R., Toxopeus, B., Ngene, S., & Omondi, P. (2015). Spatial and spatiotemporal clustering methods for detecting elephant poaching hotspots. *Ecological Modelling*, 297, 180–186.
- Reis, R. (1999). Environmental news: Coverage of the Earth Summit by Brazilian newspapers. *Science Communication*, 21, 137–155.
- Sahramäki, I., Korsell, L., & Kankaanranta, T. (2015). Prevention of environmental crime through enforcement—Finland and Sweden compared. *Journal of Scandinavian Studies in Criminology and Crime Prevention*, 16, 41–59.

- Schultz, I., & Flyghed, J. (2016). Doing business for a “higher loyalty”? How Swedish transnational corporations neutralise allegations of crime. *Crime, Law and Social Change*, 66, 183–198.
- Shaffer, M. J., & Bishop, J. A. (2016). Predicting and preventing elephant poaching incidents through statistical analysis, GIS-based risk analysis, and aerial surveillance flight path modeling. *Tropical Conservation Science*, 9, 525–548.
- Sheley, J. F., & Ashkins, C. D. (1981). Crime, crime news, and crime views. *Public Opinion Quarterly*, 45, 492–506.
- Sherman, L. W. (1995). Hot spots of crime and criminal careers of places. In J. E. E. D. Weisburd (Ed.), *Crime and place, crime prevention studies* (pp. 35–52). Criminal Justice Press.
- Shimshack, J. P., & Ward, M. B. (2005). Regulator reputation, enforcement, and environmental compliance. *Journal of Environmental Economics and Management*, 50, 519–540.
- Siponen, M., Vance, A., & Willison, R. (2012). New insights into the problem of software piracy: The effects of neutralization, shame, and moral beliefs. *Information & Management*, 49, 334–341.
- SNRDA. (2005). *Sveriges gles- och landsbygder 2005* [Sweden’s rural and country sides 2005]. Edita Västra Aros.
- Statens Offentliga Utredningar [State Public Reports]. (2002). *Polisverksamhet i förändring. Delbetänkande från polisverksamhetsutredningen* (p. 70). Justitiedepartementet, Statens Offentliga Utredningar.
- Statistics Sweden. (2017). *Population in the country, counties and municipalities on 31 December 2017 and population change in 2017*.
- Sykes, G. M., & Matza, D. (1957). Techniques of neutralization: A theory of delinquency. *American Sociological Review*, 22, 664–670.
- Thomson, R., Espin, J., & Samuels-Jones, T. (2020). Green crime havens: A spatial cluster analysis of environmental crime. *Social Science Quarterly*, 101, 503–513.
- Von Essen, E., & Allen, M. P. (2017). Reconsidering illegal hunting as a crime of dissent: Implication for justice and deliberative uptake. *Criminal Law and Philosophy*, 11, 213–228.
- Von Essen, E., Hansen, H. P., Källström, H. N., Peterson, M. N., & Peterson, T. R. (2015). The radicalisation of rural resistance: How hunting counterpublics in the Nordic countries contribute to illegal hunting. *Journal of Rural Studies*, 39, 199–209.
- Weisburd, D. (2018). Hot spots of crime and place-based prevention. *Criminology & Public Policy*, 17, 5–25.
- Weisburd, D., Morris, N., & Groff, E. (2009). Hot spots of juvenile crime: A longitudinal study of arrest incidents at street segments in Seattle, Washington. *Journal of Quantitative Criminology*, 25, 443–467.
- Wellsmith, M. (2011). Wildlife crime: The problems of enforcement. *European Journal on Criminal Policy and Research*, 17, 125–148.
- White, R. (2008). *Crimes against nature: Environmental criminology and ecological justice*. Willan.
- White, R. (2013). *Crimes against nature: Environmental criminology and ecological justice*. Willan.
- Whyte, D. (2016). It’s common sense, stupid! Corporate crime and techniques of neutralization in the automobile industry. *Crime, Law and Social Change*, 66, 165–181.
- World Bank. (2018). *Rural population* [Online]. <https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=SE>

Author Biographies

Richard Stassen holds an MSc in sustainable urban planning and design from KTH Royal Institute of Technology, Stockholm, Sweden. In 2018, he worked as a research assistant in the Division of Urban and Regional Studies at KTH and was involved in several research projects. He currently works in private practice as a consultant specializing in demographic forecasting and spatial analysis.

Vania Ceccato is a professor at the Department of Urban Planning and Environment, School of Architecture and the Built Environment, KTH Royal Institute of Technology, Stockholm, Sweden. Her past research is international in outlook and has mostly focused on the situational conditions of crime and fear in urban and rural environments from an interdisciplinary perspective. She is the coordinator of the national network Safeplaces (Säkraplats) funded by the Swedish National Crime Prevention Council (BRÅ).