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INTRODUCING CONSERVATION CRIMINOLOGY

Towards Interdisciplinary Scholarship on Environmental Crimes and Risks

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Environmental crimes, noncompliance and risks create significant harm to the health of humans and the natural world. Yet, the field of criminology has historically shown relatively little interest in the topic. The emergence of environmental or green criminology over the past decade marks a shift in this trend, but attempts to define a unique area of study have been extensively criticized. In the following paper, we offer a conceptual framework, called conservation criminology, designed to advance current discussions of green crime via the integration of criminology with natural resource disciplines and risk and decision sciences. Implications of the framework for criminological and general research on environmental crime and risks are discussed.

Keywords: conservation criminology, environmental risk, environmental crime, green criminology

Introduction

Environmental crimes, noncompliance and risks create significant immediate and future harms to the health of humans and the natural world. Illustrations of these harms include infamous incidents of crime and negligence (e.g. Exxon Valdez; Bhopal; Hooker Chemical Company; Hout Bay Fishing Industries) and the indirect impacts of historically unregulated behaviours (e.g. greenhouse gas emissions from the use of fossil fuels). Unfortunately, these represent only a few examples of the harms posed to the environment by individual, collective, corporate and government actions.

Yet, the field of criminology has historically shown relatively little interest in these issues. Criminologists have documented notable examples of environmental crimes and negligence by companies, governments and organized crime groups, but this aspect of the criminological literature has historically lacked the theoretical and methodological depth and breadth of other facets of criminology, such as the study of street crime. This is due to the fact that environmental studies have largely been left to other disciplines (Lynch and Stretesky 2003; South 1998).

The recent emergence of 'environmental' or 'green criminology' marks a shift in this trend.[1] Over the past decade, a small group of scholars have initiated discourse and offered several competing definitions of green criminology, attempting to distinguish it as a unique area of study (Halsey 2004; 2006; Herbig and Joubert 2006; Lynch and Stretesky 2003;

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[1] 'Green criminology' is the term that criminologists use most often to describe this area of study, often referring to environmental crime, environmental harm or green crime as the domain of study. Although we prefer the term 'conservation criminology' (as discussed below), we use the term 'green criminology' to describe the general state of prior research and the authors' original terminology when describing specific contributions.

South and Beirne 1998; White 2008). Currently, there is no consensus on the definition of green criminology or the appropriate terminology to describe it. In fact, the existing definitions have been extensively criticized, leading some to suggest that criminology does not possess a lexicon adequate to advance a green criminology (Halsey 2004).

In the following paper, we offer a multidisciplinary framework that builds on the strengths and addresses key limitations of prior approaches to green criminology, largely by integrating criminology with natural resource disciplines and risk and decision sciences. Given the constraints associated with the terms 'green' and 'environmental criminology', we prefer the term 'conservation criminology' to describe our framework.[2] We begin with a critical review of the existing literature on green crime. Our review integrates all of the major perspectives described in the prior literature and clarifies differences in content, terminology and classification. We next describe our framework, including how it addresses the limitations of prior definitions; the types of real-world issues that fall within the scope of conservation criminology; and the disciplines we integrate to construct the framework. To demonstrate the utility of conservation criminology, we offer a case study on electronic waste. We conclude by discussing key implications of the framework for both criminological and general research on environmental risk. With further testing and refinement, we believe the conservation criminology framework will inform more effective research on, discourse about and governance of environmental crimes and risks.

Criminological Approaches to Green Crime

Current definitions of green crime range from criminal violations of environmental law to any act that harms or disrupts ecosystems. Overall, environmental practices are described as criminal/harmful based on how scholars prioritize the values and interests of relevant stakeholders (e.g. publics, corporations, 'nature') (White 2008). Each definition reflects a particular philosophical stance on the appropriate relationship between human beings and nature (i.e. human-centred, nature-centred, balanced), the causes of green crime and the appropriate intervention to address them.

Liberal ecology or legalist perspectives[3]

Some scholars use a strict legalist perspective, defining environmental crime as violations of criminal laws designed to protect the health and safety of people, the environment or both (Clifford and Edwards 1998; Situ and Emmons 2000). The scope of the legalist perspective is ambiguous partially due to contention over whether environmental crime

[2]We use conservation criminology as our preferred terminology for several reasons. Environmental or ecological criminology typically refers to the spatial study of criminal events. Green criminology is also problematic due to its association with political perspectives (and the narrow range of associated issues) and its ambiguity (Herbig and Joubert 2006). We concur with Herbig and Joubert (2006) that conservation criminology identifies the core theme of this area of study. We draw upon literature that defines conservation as the wise use and management of any natural resource (Allaby 1994). Contrary to the narrow focus on species and landscapes associated with preservationist philosophies, human dimensions are key to conservation (Allaby 1994). Thus, conservation can encompass wildlife, pollution, people and other dimensions that are often considered to be mutually exclusive. The term 'criminology' implies some focus on issues of crime and compliance. Thus, conservation criminology is the study of environmental risks at the nexus between humans and natural resources that involve issues of crime, compliance and/or social control.

[3]Halsey (2004) uses the term 'liberal ecology' to categorize this work, but his description is consistent with legalistic and socio-legalistic definitions of crime.

encompasses crimes against people (e.g. occupational health and safety crimes). In addition, definitions of 'the environment' and descriptions of which laws are designed to protect it are absent. In terms of content, some authors focus exclusively on pollution crimes (Situ and Emmons 2000) while others include wildlife crimes such as violations of the US Endangered Species Act (Clifford and Edwards 1998). In focusing on criminal violations of these laws, these authors imply that criminal penalties are the optimal way to address these offences.

Most green criminologists argue that studying criminal violations of environmental law is too narrow, as environmental harms may be socially constructed as civil or regulatory violations, legal or normative behaviours (White 2008). Socio-legal definitions of crime used by white-collar and corporate crime scholars include civil and regulatory violations, equating crime to any illegal activity (Braithwaite 1984; Sutherland 1961). These scholars have not addressed the scope issue (i.e. which laws are 'environmental') because most of this research has not been framed as green criminology. However, within the realm of the legalistic perspective, the majority of the existing environmental research focuses on business violations of pollution control laws (e.g. Alexander and Cohen 1996; Hill *et al.* 1992; Keane 1993; McKendall and Wagner 1997; Simpson, Garner and Gibbs 2007).

Strict legalist and socio-legal definitions of environmental crime have been criticized for failing to recognize that the current regulatory system is anthropocentric (i.e. human-centred, often to the detriment of natural systems) and assuming that environmental harms result from a failure of the existing system and may be addressed by modifying the system. As such, environmental harms that are not addressed by regulatory agencies (e.g. government environmental crime, individual automobile emissions) are ignored. In addition, these perspectives ignore the dimensions of power in the construction of the law (Halsey 2004).[4] Hauck (2008) argues that the formation of law and the power dynamics influencing such processes are critical aspects that need to be acknowledged and understood. Finally, by delineating illegal behaviour as unique, the legalistic perspective assumes that the causes of environmental noncompliance are somehow different from the causes of environmental harms more generally, limiting the potential for more generalizable knowledge (Halsey 2004).

Environmental justice perspectives

Green criminologists have pointed to broader definitions of crime in the environmental justice literature (Lynch and Stretesky 2003; White 2008). Environmental justice scholars argue that a disproportionate number of environmental hazards are located in economically disadvantaged and minority communities (see, e.g. Mohai and Saha 2006; 2007). Using an anthropocentric lens, social justice perspectives define environmental crime as environmental racism or classism. While moving beyond key limitations associated with the legal definition of environmental crime, this definition is still criticized as overly anthropocentric (White 2008).

[4]For example, English laws limiting the common citizen's rights to hunting and fishing on the King's land were fundamentally tied to the structuring of property rights and class relationships (Hay *et al.* 1975). Similarly, although writing about white-collar crime generally, Sutherland (1940) argued that behaviours of the powerful such as fraudulent stock manipulation or illegal release of toxic chemicals might not have been defined as illegal due to the power of interest groups to preclude such legal definition, but that criminologists should focus on such behaviours that (he believed) cause more harm than many other types of common crimes.

Ecocentric perspectives

Broader justice perspectives define green crime as 'an act that may or may not violate existing rules and environmental regulations; has identifiable environmental damage outcomes; and originated in human action' (Lynch and Stretesky 2003: 227).[5] The causes of environmental harm are considered identical to the causes of social injustice. This perspective synthesizes ecofeminist, ecomarxist and social ecology discussions of power, arguing that gender, race and class inequalities are the central causes of harm to humans *and* the environment.[6] 'Criminality is related to the exploitation of both environments and humans by those who control the means of production' (White 2008: 20). As such, social and environmental justice is inextricably bound and can be achieved by creating a new, harmonious pattern of interaction with nature (Halsey 2004). Thus, the remediation of environmental harm requires a substantial shift towards more egalitarian political and economic systems that recognize (and give equal consideration to) the intrinsically important qualities of the environment (Halsey 2004; Lynch and Stretesky 2003; White 2008).

Biocentric perspectives[7]

Finally, other green criminologists offer 'deep green' or 'biocentric' definitions of environmental harm as any human activity that disrupts a biotic system (Halsey 2004). For example, Herbig and Joubert (2006) define 'conservation crime' as 'any intentional or negligent human activity or manipulation that impacts negatively on the earth's biotic and/or abiotic natural resources, resulting in immediately noticeable or indiscernible (only noticeable over time) natural resource trauma of any magnitude' (Herbig and Joubert 2006: 96). Similarly, White (2008) proposes a typology of primary (i.e. direct destruction and degradation of environmental resources) and secondary (i.e. violations of rules that regulate environmental disasters) environmental crime. These perspectives prioritize the intrinsic value of ecosystems over human interests. Accordingly, human beings are the cause of environmental harm and need to be controlled. Potential solutions range from criminalizing additional human activities to eradication (White 2008).[8]

Critical reflections on existing literature

Each aforementioned perspective on environmental crime offers a unique philosophical stance on the definition, underlying causes and potential solutions to the problem of green crime. Importantly, these diverse perspectives encourage discussion about how to

[5] Lynch and Stretesky (2003) refer to this as an 'environmental justice' perspective. Like traditional environmental justice frameworks, their perspective emphasizes the role of power and inequality in creating environmental harm, but it does not contain the same anthropocentric bias. Thus, like Halsey (2004), we categorize their definition of green criminology as an ecocentric perspective.

[6] Ecomarxists, ecofeminists and social ecologists argue that environmental harms respectively result from capitalism, patrarichy and domination in general (Halsey 2004).

[7] Some authors combine ecocentric and biocentric perspectives under the caption of 'ecological justice' because both prioritize 'the environment' over human interests (White 2008). We acknowledge the similarities, but present them separately to demonstrate their unique contributions (e.g. ecocentric perspectives highlight issues of power and inequality).

[8] Similar approaches such as 'species justice' add considerations of animal rights, drawing attention to issues of discrimination against non-human animals (White 2008).

move beyond a legalistic definition of environmental crime. Yet, these viewpoints have shared weaknesses. First, the philosophical stance taken by each perspective narrows the focus to certain causes of crime while ignoring others (White 2003). For example, Lynch and Stretesky (2003) use an ecocentric framework to argue that environmental harm is a consequence of the primacy of the economic sphere over other social structures. While it is important to examine how issues of power shape environmental practices, extant literature reveals other causes of environmental crime, such as lack of knowledge of applicable law (Brehm and Hamilton 1996; Nada 2001) and perceptions that criminal justice and/or regulatory interventions are illegitimate or unreasonable (Bardach and Kagan 1982; Hatcher *et al.* 2000; Hauck 2008). The emphasis on economic power as the primary cause of environmental crime also seems unable to account for findings of corporate over-compliance with environmental regulation and law as well as investment in 'green' technology that often incurs at least short-term costs (Kagan *et al.* 2003; Thornton *et al.* 2003).

Outside of the regulatory arena, individual automobile use and consumption choices are known to create significant environmental harm (Vandenbergh 2004). Some argue that these individual choices reflect the primacy of economic power, 'how human beings produce, consume and reproduce themselves is socially patterned in ways that are dominated by global corporate interests' (White 2003: 494). However, research indicates that individual decisions vary and are based on a variety of factors. For example, the use of public transportation varies widely by city (Van Vugt *et al.* 1995). Decisions to take public transportation versus personal cars depend on factors such as scarcity of parking and traffic flow as well as social value orientation: individuals who are more concerned with collective welfare tend to take public transportation more often than those more concerned with individual welfare (Van Vugt *et al.* 1995). In addition, individual routine behaviour is often simply the result of habit (Vandenbergh 2004). Finally, in the wildlife arena, scholars find that stakeholders' vulnerability to hazards, such as human–wildlife conflict, influences their perceptions of risk associated with the hazard (Nathan 2008; Orga 2008), which, in turn, may influence their hazard-related compliance behaviour (Satterfield *et al.* 2004). Thus, the literature indicates a variety of factors that may influence behaviour. It is unlikely that all of these influences (e.g. value orientation, perceptions of vulnerability) are created by corporate interests. Minimally, these examples point to empirical questions from which theory can be tested and revised rather than taken as a given.

Second, each perspective promotes a particular solution (e.g. limit human population growth, criminalize additional behaviours) that might not be appropriate for certain situations and overlooks other solutions that may be better suited (Halsey 2004). For example, social justice perspectives imply that a shift towards more egalitarian political systems is the optimal solution while ignoring the role of regulation, enforcement, education and social norms (even in a more egalitarian system). By limiting solution alternatives, these perspectives overlook the option for multiple interventions to address a particular problem (Gunningham and Grabosky 1998/2004). Additionally, in making a priori assumptions about the causes of and appropriate interventions for reducing green crime, these perspectives inappropriately assume away empirical questions. Analysis that 'reinforces rigid definitions and absolutist positions (e.g., humans come first; the earth is most important; any harm to animals is bad) precludes closely considered analysis of specific situations' (White 2008: 25). These perspectives also

promote a static approach to an inherently dynamic issue. As reflected in the ambiguous and varied terminology (e.g. using the terms environmental and ecological interchangeably), these perspectives also suffer from a lack of connection to other disciplines. For example, assessing the nature and scope of 'environmental harms' requires contributions from a variety of disciplines and stakeholders beyond criminology.

Green criminology needs an interdisciplinary framework that is more comprehensive, adaptive and neutral—one that does not presume to know the answers in advance (White 2008). In the following section, we introduce a framework that we believe offers a response to the current state of theoretical affairs (i.e. sparse selection, limited in scope, an overly anthropogenic, ecocentric or biocentric focus) and is largely consistent with White's (2008) recommendations for advancing this area of study. In offering this approach, we hope to promote additional, multi- and interdisciplinary criminological scholarship on environmental issues and foster discourse about environmental governance.

Introducing Conservation Criminology[9]

In developing our framework, we were guided by several factors. First, we sought to build on the existing green criminology literature, including the call for a broader interdisciplinary framework with theoretical and practical value (White 2008). Second, we were influenced by the literature on coupled human and natural systems (CHANS) (see Liu *et al.* 2007) that promotes interdisciplinary scholarship (e.g. incorporates multiple theories, data collection, management, analysis and synthesis techniques), acknowledges both short and long-term dimensions and explicitly addresses complexity and feedback loops.[10] Finally, we relied upon principles of inductive reasoning to promote learning and refinement of the framework through trial and error and systematic observation.

To advance these goals, we present our initial conceptualization of a conservation criminology framework in Figure 1. In the following section, we provide a discussion of the framework, beginning with the scope. We concur with previous scholars that conservation criminology need not be limited to behaviours that have been defined as criminal (i.e. the legalist perspective), but we reject previous definitions and typologies of conservation crime (i.e. the social justice and biocentric perspectives). We propose that conservation criminology can be advanced through the examination of environmental crimes and risks that lie at the intersection of criminology, natural resources and risk sciences. Purposefully, we do not offer a singular definition of conservation criminology or its scope. Instead, we offer our ideas regarding the types of problems that may be best addressed using the conservation criminology framework.

[9] We acknowledge Herbig and Joubert's (2006) use of the term 'conservation criminology' and the advance offered, but we take a markedly different approach. Rather than offering an a priori definition of this area of inquiry, we provide a framework that seeks to build generalizable knowledge about environmental crimes and risks using principles of inductive reasoning and through the integration of criminology, natural resources management and conservation and risk and decision sciences (see discussion below).

[10] Congruent with the CHANS, we are influenced by 'sustainability science'. This framework recognizes that many environmental issues represent 'wicked problems' characterized by uncertainty and value conflicts (Rittel and Webber 1973). Addressing such wicked problems requires interdisciplinary study of the 'complex dynamics that arise from interactions between human and environmental systems' (Clark 2007) and the inclusion of stakeholders. Integrative models of the conservation, human health and economic dimensions of these issues that draw upon natural, social and engineering sciences are required (Batie 2008).

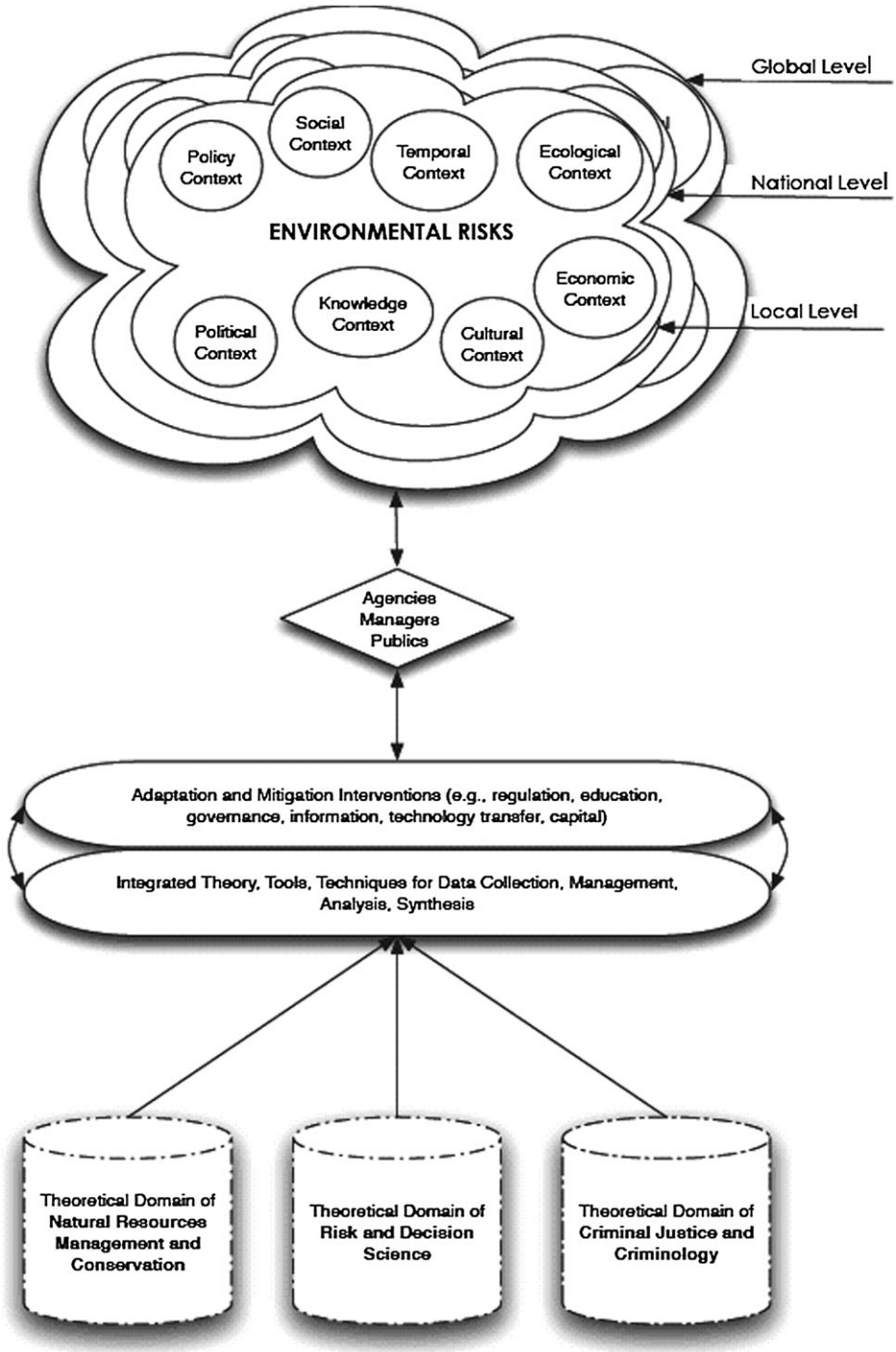

FIG. 1 Conservation criminology framework

We propose building generalizable knowledge on these environmental problems vis-à-vis a process of inductive reasoning in which scholars study specific behaviours and (potentially) build a typology from the ground up. Like Shover and Routhe (2005), we believe it is important to focus on narrowly defined problems to advance theoretical understanding and inform proactive and reactive policy decisions while also assessing similarities and differences across problems to build more general knowledge.

Our research-based approach is not intended to convey an 'uncritical adherence to the Western scientific method' (Halsey 2006: 47) or an objectivist philosophy. Rather, our perspective is relativistic in that reality is culturally and experientially constructed. As discussed below, our framework is built to incorporate many forms of knowledge and many truths. For example, our definition of environmental risk is based not only on technical experts, but also on public perceptions of risk. Our framework is most influenced by a postpositivist epistemology. For example, our framework explicitly encourages the examination of political, cultural, economic and social influences on the definition of environmental crime and risk (see Figure 1). Further, the framework encourages multi and interdisciplinary scholarship, which ultimately broadens the perspective of those involved in the collaborative process.

The scope: environmental risk

With the goal of moving beyond legalist definitions of environmental crime, we propose that the focus of conservation criminology begin with assessment of environmental risks. One advantage of doing so is that it builds upon existing risk scholarship that provides systematic tools for assessing the degree of risk for human health, natural resources and the environment. In technical assessments, risk is defined as a function of the probability of exposure to a hazard and the expected consequences of the hazard if the exposure is realized (Arvai 2007). However, technical assessments of risk often differ significantly from public perceptions, or intuitive judgments, of risk (Slovic 1987). Beyond leading to divergent evaluations about the causes of risk, differences between 'expert' assessments and 'public' perceptions can lead to conflict over how risks are managed. In response to this conflict, the field of risk and decision science has moved towards public participation in various stages of risk governance. We borrow from this approach and acknowledge that a comprehensive definition of environmental risk should be based on scientific assessments as well as public perception.[11]

The process of defining risk from the perspective of multiple stakeholders has the goal of more comprehensive and transparent decision-making processes.[12] Although these processes do not preclude conflict and difficult trade-offs, they help advance on current definitions of 'green crime' that delineate environmental practices as criminal/harmful based on how scholars prioritize the values and interests of each relevant party (e.g. humans vs. nature, private vs. public). These processes and tools from risk and decision sciences increase the likelihood that 'risk' will be defined by potential consequences to

[11] Hazards considered to be both high and low-risk are the focus of risk management strategies; low-risk hazards may carry high-risk perception (Slovic 1987).

[12] The inclusion of stakeholders is increasingly a point of convergence across the fields of criminology, natural resources management and risk and decision science.

all stakeholders. For example, risk scholars may be equally concerned about loss of habitat and economic vitality rather than prioritizing one over the other.[13] In addition, the inclusion of scholars from multiple disciplines can bring implicit values to light (Bammer 2008). Thus, our proposed framework allows for the consideration of multiple 'victims' and 'offenders', including anthropogenic (human) causes of environmental risk as well as threats posed to humans by the environment (e.g. human–wildlife conflict, natural disasters). As such, our framework recognizes multiple causes of environmental risks (e.g. environmental risks to humans *and* the environment are rooted in social and ecological processes, structures and reactions) and is not tied to any particular solution.

While not restricting research to certain causes of environmental risk, our framework encourages the recognition of powerful groups that may control the framing and definition of environmental risks (White 2008). Risk scholars recognize that scientific assessments and public perceptions of environmental risks are defined within a political, economic, social and cultural context (Beck 1992; Douglas and Wildavsky 1982; Zinn and Taylor-Gooby 2006). Consistent with criminological discussions of the social construction of law, risk scholars invite analysis of how, why and when certain actions are defined as risks.[14]

The concept of risk is also sufficiently adaptive to incorporate a variety of environmental problems, ranging from compliance with small-scale fisheries in South Africa (Hauck and Kroese 2006; Hauck 2008) and international trade in electronic waste (Gibbs, Melvin, McGarrell and Axelrod 2008) to public perceptions of wildlife-related risk and human-wildlife conflict (Gore *et al.* 2006). Similar to a recognition that legal definitions change over time, the definition of hazards as environmental risks can change to reflect current knowledge, perception and levels of concern. Current, emerging and future environmental risks may be examined in the conservation criminology framework. In addition, the construct of risk is applicable at multiple scales (e.g. individual, socio-cultural and collective) and multiple domains (e.g. local, regional, global) (Gore and Riley 2007; Renn 2008). Finally, the concept of risk is not limited to direct risks; indirect and latent effects are also relevant. Thus, the framework we propose offers the opportunity to examine indirect and direct environmental risks at multiple scales.

The nexus of risk and crime: further defining the scope

Relying exclusively on risk to define the scope of conservation criminology can open the field of inquiry so broadly that conservation criminology becomes indistinguishable from other environmental disciplines, such as environmental science and policy. As Herbig and Joubert (2006) argued, the current terminologies (e.g. ecological crime, green crime, environmental crime) are ambiguous in distinguishing a unique form of crime. Without a unique identity, research has not advanced. Thus, without explicit consideration of the nexus between risk, environment and crime, we fail to create a unique identity from which a body of theory and research can develop.

[13] In addition to more traditional risk metrics, such as harms to natural resources, human health and economic viability, Gregory (2008) advocates assessment measures and stakeholder inclusion processes that would take into account 'invisible losses' such as lifestyle changes, intergenerational knowledge and culture transmission, loss of social structure and fear or worry accompanying uncertainty.

[14] In fact, the relationship between environmental risks and context may be explored from several directions, making it possible to understand the influence of context on environmental risk as well as the inverse.

Environmental harms that are currently defined as crimes or illegal activities (i.e. violations of civil or regulatory law) clearly fall within the scope of conservation criminology. Anthropogenic actions (or negligence) at the individual, collective, corporate and state levels that produce harm, or the potential of harm, to people and the environment through the 'illegal manipulation and exploitation of natural resources' (Herbig and Joubert 2006: 88) are included.[15] Examples include pollution infractions (e.g. pollution discharges over the legal limit, illegal disposal of hazardous waste), wildlife violations (e.g. trade in endangered species), the illegal extraction of natural resources (e.g. illegal logging, fishing, mining and plant removal) and illegal land management (e.g. illegal filling of wetlands, endangered species habitat removal) (Herbig and Joubert 2006; White 2008).[16]

A grey area emerges for environmental risks that are not currently subject to regulation or criminal enforcement but where further understanding of the risk may lead stakeholders to argue for regulation and/or criminalization. Topics are not limited to those raised by scientists. Issues arising from public perceptions of risk may also benefit from a conservation criminology framework. For example, scientists and environmental interest group communities are discussing the need to regulate the release of pharmaceuticals into the environment (Daughton 2003). Similarly, some scholars have become increasingly concerned with the use of nanotechnology and its possible influence on the natural environment (Warheit *et al.* 2008). Assessing, managing and developing risk communication strategies (intended to influence citizen or corporate behaviour) through deliberative processes that include scientific analysis and stakeholder concern fall within the scholarly domain of risk. However, if scientific assessment and stakeholder concern create a serious consideration of systems to regulate nanotechnology, the issue will fall within the scope of conservation criminology.

The benefit of using the conservation criminology framework is also apparent when examining contests over defining environmental risks as illegal. Criminologists are knowledgeable about the legal system, but are not trained to scientifically assess threats to the natural environment. Thus, criminologists could provide information on the circumstances under which legal versus other tools may be most effective while natural resource scientists offer insight into the impact of various stimuli on natural resources and ecosystems. Similarly, risk scholars provide established tools to assess the risk to natural resources and humans. Assessment of the magnitude and likelihood of harm, judged in relation to benefits derived from the source of the risk, can inform legal decision makers. Thus, the inclusion of scholars from these three fields provides a broader scientific foundation for normative discussions surrounding decisions to regulate and/or criminalize certain acts.

We also move beyond illegal behaviour to include environmental risks with a 'nexus to crime'. For example, we believe that research on some environmental risks with natural causes would benefit from a conservation criminology framework. Natural disasters often generate chaos and natural resource conflicts, requiring social control in emergency management systems and processes. Thus, using the conservation criminology

[15] Such harms may also extend to human health.

[16] The concept of risk implies some level of uncertainty regarding the outcome of a particular decision or action. Therefore, criminal or illegal activities that have already caused environmental harm should not be referred to as risks. The domain of Conservation Criminology includes both types of environmental activity (i.e. illegal activity and a broader set of risks described below).

framework may facilitate scholarship on the role of social control and other public and private agencies and stakeholders in preventing and mitigating harm to human health, economic sustainability and the environment in the context of natural disasters. The conservation criminology framework could also be used to understand the technical assessment and public perception of earthquake risks and ecosystem impacts. Finally, the conservation criminology framework could generate theory and research on the role of human behaviour in exacerbating or mitigating the causes and consequences of natural disasters. For example, the framework may improve understanding of human activities (e.g. carbon release, development and construction decisions) that contribute to the frequency, scale and consequence of natural disasters (e.g. Green 2005).

The disciplines

Three disciplines form the foundation of conservation criminology: criminal justice and criminology, risk and decision analysis, and natural resource conservation and management. We believe the synergy of these disciplines can address a variety of environmental risks that occur at their intersection.

Criminology is 'an interdisciplinary profession built around the scientific study of crime and criminal behavior' (Schmalleger 2005:15). Over the last 100 years, the field of criminology has developed significant strengths in understanding human behaviour as well as criminal justice interventions designed to shape that behaviour. Many areas of criminological research are relevant to conservation criminology, including strategies for measuring criminal behaviour (e.g. official data, self-reports, victimization surveys); theories of criminal events and behaviour from a variety of philosophical perspectives (e.g. conflict, consensus, interactionism), levels (micro, macro) and disciplines (e.g. sociology, psychology, economics); evaluations of formal and informal methods to reduce the likelihood of crime; and analysis of the social construction of the law. Further, white-collar crime scholars offer theories of corporate crime and increasingly theories of environmental compliance to conservation criminology. Finally, the combined scholarship of traditional and white-collar criminologists produces a variety of statistical and methodological tools for exploring issues of environmental crime and criminal behaviour. Criminology offers an analysis of criminal actors (e.g. people and companies) to conservation criminology.

Natural resource disciplines, on the other hand, offer knowledge and systematic tools and methods to measure, manage and conserve natural resources ecosystems and the people that interact with them. Natural resource conservation and management are the processes of making decisions and taking actions about the natural resources that people value (Decker *et al.* 2001).[17] The elements of management processes—policy goals, objectives, action and evaluation—are informed by data such as species population dynamics, community dynamics (e.g. food webs), nutrient recycling, energy flows and production, habitat requirements, species' range and interaction with their environments and human attitudes and behaviours about wildlife management (Decker *et al.* 2001). The historical focus on specific biota or resources has slowly evolved into a focus on the ecosystem within which a particular resource is found (Mulder and Coppolillo 2005).

[17] Values may be aesthetic, scientific, utilitarian or moralistic in nature (Kellert 1980) and change over time.

This ecological dimension figures heavily into natural resource conservation and management and has led to theories that provide insight into the disequilibrium of natural systems (which may or may not include people) (Krebs 2008).[18]

Complementing criminology and natural resource management, risk and decision sciences offer scientific risk assessment and tools to understand risk perception. As stated, historically, risk and decision sciences viewed risk as largely a technical question, but the field now incorporates subjective risk perception. Perception of risk can influence stakeholder support for conservation, motivate behaviour change, enhance receptivity to educational messages (Gore *et al.* 2006) and predict an intervention's ability to build people's capacity and willingness to take action to reduce a risk (Arvai 2007). Thus, understanding risk perception can inform risk management and governance.[19]

Uncertainty is another important element of the environmental risks that fall within the conservation criminology framework. In many cases, either the probability of exposure to the hazard is unknown and/or the precise consequences of exposure to the hazard are not clear. Under these conditions, decision-analysis techniques and decision theory are useful. Although humans are fairly good at making decisions (Hastie and Dawes 2001; Plous 1993), they are poor at making decisions that involve complex systems and high levels of uncertainty (Johnson and Slovic 1998; Kahneman and Tversky 1979). Formal decision theory allows us to determine the heuristics and decision processes that can exacerbate many environmental risks.[20] Decision-analysis techniques can also improve the decision-making process with the use of prescriptive decision tools such as structured decision making (Gregory *et al.* 2001; Hammond *et al.* 1999). A variety of decision-analysis tools also address the inclusion of multiple stakeholders into the decision process, a pressing need in confronting most environmental risks.[21]

As Table 1 illustrates, we believe the historical specializations of these three disciplines are complimentary and the limitations compensatory.[22] In addition, these disciplines have independently developed a series of shared traits, which could be considered a form of contemporary and disciplinary 'convergent evolution'.[23] Within the past few decades, each discipline has moved in similar directions (e.g. engaged in critical reflection of and movement beyond the limitations). As such, we believe that these

[18] Bell *et al.* (2007) cautioned that illegal use of natural resources, such as poaching of wildlife, should not be approached simply as an individual (i.e. person or species) or collective (i.e. community or population) action problem. The literature is devoid of applied research considering the multiple dimensions (i.e. socio-cultural, individualistic and collective) of illegal resource exploitation.

[19] Risk management may be directed at mitigating assessed risks or helping people adapt to hazards. Risk communication, a common mitigation and adaptation strategy, is the process during which people, usually experts and non-experts, exchange information about a hazard (Arvai 2007). The process, content and intent of risk communication has traditionally been to inform or influence risk management decisions (Gregory 1989).

[20] Heuristics are decision shortcuts that work great for simple decisions, but can lead to significant problems when used to address more intricate problems (Plous 1993).

[21] Increasingly, risk scholars have also focused on governance (Renn 2008). Risk governance includes a focus on 'the complex web of actors, rules, conventions, processes, and mechanisms concerned with how relevant risk information is collected, analysed and communicated, and how management decisions are taken' (Renn 2008: 9). This is particularly important in the domain of conservation criminology whereby value conflicts (e.g. property rights, common goods) and risk balance calculations (e.g. conservation, development) are endemic.

[22] The interdisciplinary nature of these fields also makes them uniquely suited to provide the base for conservation criminology and amenable to the inclusion of insights of other disciplines.

[23] Convergent evolution represents a phenomenon when two distinct species with differing ancestries evolve to display similar physical features (Gould 2002).

Table 1 *Historical areas of specialization and limitations of conservation criminology disciplines*

Discipline	Historical specialization	Limitation*	Evidence of contemporary and emergent evolution
Natural Resource Mgt	Understanding natural systems and their interactions	Focus on ecology and biology to the exclusion of people	• Critical reflection upon and movement beyond core weakness • Stakeholder involvement/ public participation • Application of multi and interdisciplinary theory • Broader contextual application • Adaptive and proactive • Evidence-based
Criminal Justice and Criminology	Understanding human behaviour and crime control	Focus on legally defined crimes to the exclusion of similar harmful behaviours	
Risk and Decision Science	Systematic approach to characterizing risk	Focus on experts and technology to the exclusion of public perception	

* Limitation in the sense of studying environmental risks and crimes from a single disciplinary perspective.

three disciplines are uniquely positioned to offer greater breadth and depth of understanding to diagnosing problems and characterizing solutions to environmental crimes and risks. We are currently calibrating the framework with a diverse array of research projects. In the following section, we offer details about one such research initiative as a case study to demonstrate the utility of the framework.

Electronic Waste (E-Waste)

E-waste is a significant environmental risk and emerging regulatory issue.[24] Each year, tons of high-tech electronics become obsolete and are in need of disposal (Grossman 2006). Extensive literature documents the toxicity of E-waste contents and the negative effects to humans and the environment, especially when improperly disposed (Gibbs *et al.* 2008). Computer and television displays contain an average of one to four kilograms of lead each (Pellow 2007; Silicon Valley Toxics Coalition 2008); other electronics also contain toxic substances, such as mercury, hexavalent chromium, arsenic and polychlorinated biphenyls (PCBs), which cause a range of negative effects on human health, including organ failure and cancer (Jackson *et al.* 2006). These substances also cause harm to the environment, such as ozone depletion and ground water contamination (Computer Takeback Campaign 2004; Silicon Valley Toxics Coalition 2008). In fact, E-waste is particularly dangerous because it has the potential to contaminate both terrestrial and aquatic ecosystems in urban and rural areas.

The potential threat of E-waste is magnified by the lack of suitable disposal methods. For example, in 2005, the majority of U.S. E-waste was disposed of in landfills or incinerated. The bulk of E-waste gathered for recycling in the United States is exported to developing nations for remanufacture or refurbishment (US EPA 2007). It is significantly less expensive for U.S. businesses to export E-waste for recycling than to do so domestically. However, many recycling facilities in developing nations are not properly equipped to handle E-waste and much of the waste is improperly dumped in local villages near people

[24] There is no universally accepted definition of electronic waste, but definitions often include obsolete, broken or irreparable electronic equipment such as televisions, computers and computer monitors, etc. (Luther 2007).

and/or water sources without any processing (Pellow 2007). Illegal dump sites have been documented in Nigeria, Ghana, China and India (Greenpeace 2008).

Despite the significant risks posed by E-waste, regulation varies significantly across the globe. The Basel Convention is an international voluntary treaty that prohibits the export of hazardous waste from 'developed' to 'developing' nations. The Organization on Economic Cooperation and Development (OECD) also prohibits the export of hazardous waste unless the wastes are sent to an adequate disposal facility (Tonetti 2007*a*; 2007*b*). Furthermore, many countries have passed legislation to regulate and enforce commitments to these treaties while others have not. The European Union banned the export of E-waste to developing nations; however, the United States never ratified the Basel Convention, did not update its definition of hazardous waste to be consistent with the OECD rules (of which the United States is a member) and continues to export many forms of E-waste via an ineffective notification and consent process (US GAO 2008; Tonetti 2007*a*; 2007*b*). Thus, E-waste is an excellent example of an environmental risk that involves some issues of compliance, but is not necessarily criminalized.

A discussion of potential research on E-waste demonstrates the utility of the conservation criminology framework, as research combining the core disciplines of conservation criminology would advance knowledge and offer more insight into policy on E-waste than relying on any one. The field of criminology could make significant contributions to understanding the criminal activities and actors relevant to E-waste. White-collar crime scholars offer theories of corporate crime (Coleman 1987; Lasley 1988; Makkai and Braithwaite 1991; Passas 2000; Simpson and Koper 1997; Vaughan 1996) and, increasingly, theories of business environmental compliance (Cohen 2008; Kagan *et al.* 2003; May 2005; Thornton *et al.* 2003), methodological tools for studying business crime (Alexander *et al.* 2000; Clinard and Yeager 1980; Paternoster and Simpson 1996) and strategies to overcome the challenging task of measuring business crime (Gibbs and Simpson 2009; Green 1990; Simpson *et al.* 1993). A team of Michigan State University researchers is currently engaged in research from this perspective, exploring business violations of and compliance with existing regulations and assessing the utility of extant corporate crime theories for explaining them (Gibbs *et al.* 2008).[25] In addition, the team is examining the potential role of organized crime groups that facilitate international movement of E-waste as well as linkages between E-waste and other types of emerging crimes (e.g. identity theft). Finally, consistent with traditional criminal justice evaluation research, the team is examining the utility of various policy alternatives for better addressing the problem of E-waste. Thus, criminological research can make a variety of significant contributions to understanding and addressing E-waste.

Yet, this research involves only one aspect of the E-waste problem: the criminal elements. Drawing on natural resource, risk and decision science would increase our knowledge regarding other relevant actors and impacts. The link between stakeholders' consumption and disposal of electronics and their perception of risk associated with these actions is a critical aspect of the E-waste issue, as risk perception is one predictor of actual behaviour (Cho 2003; Needham and Vaske 2006). The fields of risk communication and decision sciences offer theoretical frameworks and methodological

[25] An interim report is available upon request from the lead author.

tools to systematically explore stakeholders' attitudes and potentially change behaviours associated with electronics consumption and disposal. For example, it is unknown how consumers perceive the risks that E-waste poses to human health and the natural environment, but current practices suggest that many underestimate the potential hazard. Decision heuristics (i.e. mental shortcuts) and biases may help explain the public's low risk perception. The availability heuristic suggests that individuals rely on the most salient, but not necessarily important, information to make decisions (Tversky and Kahneman 1973). If the most salient information is cost, performance and reliability rather than environmentally friendly construction materials and product longevity, consumers will make decisions that increase E-waste without adequate consideration of the risks. Influencing risk perception (e.g. via risk communication) and addressing decision heuristics (e.g. via structured decision making) can promote better decision making and therefore a change in actual behaviour.

The field of natural resources also offers critical insight into ecological impacts of E-waste on the natural environment and humans that interact with it. For example, landscape ecologists can offer insight into how, where and to what effect various contaminants degrade different ecosystem types such as wetlands or riparian zones. Conservation biologists can detail how disparate toxins influence the reproduction, fecundity and behaviour of wildlife species and bioaccumulate through food webs to humans. Scholars of human dimensions of natural resource management can detail the social implications of decreased or modified ecosystem services such as clean air and water. Finally, natural resource scholars can help determine how long contaminants persist in an ecosystem, whether the effects change over time and how flora and fauna adapt to contamination clean-up.

In addition to advancing knowledge, drawing on risk and decision science and natural resource disciplines can broaden the suite of potential policy interventions, their evaluations and ensure that more, diverse stakeholders are included in decision-making processes. Criminologists are well suited to discuss the options of crime prevention and additional regulation and enforcement to address E-waste, but are not well versed in the methods of environmental impact assessment or structured decision making used by risk scholars to include relevant stakeholders. Ultimately, an integrated approach to this case study would facilitate multiple models of environmental decision making. In addition, incorporating information about ecosystem function, human values, attitudes and behaviours as well as criminal and regulatory information into policy making has the potential to make environmental policy more sustainable and adaptive.

Implications and Conclusion

In the last decade, criminologists have made considerable progress towards building a green criminology that defines environmental harm/crime as a unique area of study. Herein, we propose a framework of conservation criminology that builds on the strengths and addresses the limitations of current perspectives. The conservation criminology framework is a first attempt to construct an approach to build generalizable knowledge about environmental crimes and risks using principles of inductive reasoning and through the integration of criminology, natural resource disciplines and risk and decision sciences. This framework has a number of implications for research on environmental crimes and risks.

Conservation criminology can inform how we frame and conduct research, indicating the utility of multi and interdisciplinary research. Environmental risks are complex and do not fit easily into disciplinary boundaries. The explicitly stated need to integrate perspectives—within and across disciplines—forces the inclusion of multiple stakeholders, theories, methods and interventions rather than focusing exclusively on any one. Theoretical integration forces theoretical elaboration as insights regarding the strengths and weaknesses of current perspectives are shared across disciplines. As a result, the integration of disciplines increases knowledge of the relationship among and between factors that shape human interactions with the environment and choices to influence sustainability of resources.

Conservation criminology also calls for scholars to avoid a priori assumptions about the causes and solutions to environmental risks, attempting to avoid an overly anthropogenic or ecocentric definition of the problem or of potential interventions. In addition, conservation criminology calls for scholars to be dynamic and adaptive. Scholarship should evolve as technical assessments are updated, public perceptions and regulatory interventions to address environmental risk change and new issues emerge. Finally, conservation criminology encourages scholars to be guided by principles of inductive reasoning. Theory, practice and the framework itself should adapt as research generates insight into the utility of the framework for understanding and addressing specific environmental problems. With testing and refinement, we believe the framework will generate new insights into environmental research and governance as well as foster more democratic discourse about environmental crimes and risks.

There are challenges associated with multi and interdisciplinary research and governance, including a lack of reliable, longitudinal datasets and difficulties with obtaining support from decision makers entrenched in discipline-specific approaches. In addition, the research itself is challenging. The complexity of studying interactions between, not just within, human and natural systems can be daunting. The research process can also be cumbersome when working across disciplines. There are time and efficiency costs associated with learning different jargon and bringing multiple perspectives together.

A related challenge arises from the choice of terminology and the inherent differences in meaning across disciplines and cultures. Some will interpret conservation as reflecting a value choice privileging natural systems over human systems. In contrast, our use of the term refers to the wise use of natural resources within social and economic constraints (Allaby 1994) and is consistent with the emerging interdisciplinary areas of coupled human and natural systems and sustainability science. These traditions emphasize the scientific study (and the engagement of civil society) of natural *and* human systems to maximize the sustainability of humans, species, habitats and ecosystems.

Despite the challenges, there are a variety of opportunities associated with using the conservation criminology framework. This multi and interdisciplinary approach can encourage information sharing between local, national and international scholars, resulting in broader practitioner networks and rich databases. In addition, collaboration brings multiple skills and perspectives to a problem, improving the depth and breadth of knowledge and potential interventions (Bammer 2008). As such, conservation criminology can enrich the knowledge base of theories, methods and governance about environmental crimes and risks, moving us towards more generalizable theory while

also expanding the suite of governance options, applications and evaluations to move beyond limitations of single disciplines. Thus, while acknowledging the obstacles as well as the limitations of science (Halsey 2006), we believe that using and refining the framework will ultimately advance knowledge and practice regarding environmental crimes and risks.

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