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Proof of Ecocide: Towards a Forensic Practice for the Proposed International Crime Against the Environment

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This article discusses developments in international environmental justice alongside contemporary environmental forensics techniques. The article begins by providing an introduction to ecocide, the proposed international crime for the protection of the environment under International Humanitarian Law (IHL) and the concept of the legal threshold of harm. It argues that forensic awareness has a role to play in developing new legal frameworks for the protection of the environment. It describes one particular approach to the practice of environmental investigations, using the example of remote sensing. From an international justice perspective, the concern of the present article is a discussion of how innovations in remote sensing technologies have allowed non court actors, civil society groups and nongovernmental organizations access to scientific evidence. It concludes by making recommending towards establishing forensic standards for admissible evidence of ecocide crime.

Introduction

Contemporary environmental crises such as anthropogenic climate change, toxic drift, and haze, while recognized as global emergencies, pose unique challenges for international legal contexts. This is in part because such calamities are often distributed over space and time presenting aesthetic and technological challenges to their representation while complicating normative standards of harm, intention and causality. Ecocide, the widespread destruction of ecosystems, does not yet exist as a crime under international law. International prosecutions for ecological crimes have not been brought before a criminal court (McCarrick 2016). Meanwhile, greenhouse gas emissions resulting from the activities of major fossil fuel producers and deforestation that contribute to global warming are apace despite decades of climate negotiations. Suppose such environmental harm is the subject of "crime scene inves-

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tigations" for environmental forensic science. Such research might help formulate innovative legal arguments for developing ecocide as a twenty-first-century crime.

Historically, the object of forensic science is both the study of crime and its traces (Roux *et al.* 2012). According to this definition, the crime investigation starts from traces that leads to the establishment of the criminal nature of the activity and links these to the perpetrator (Roux *et al.* 2012). Environmental forensic science engages with environmental crimes, such as illegal trade of wildlife, endangered species and reconstruction of pollution events through tracing the fingerprints of contamination sources (White 2012). In the case of environmental crimes, in explaining what occured, environmental forensics can help define the legal thresholds of ecocide crime.

Environmental crime is an ever changing concept that can be theoretically framed within the paradigm of "green criminology." For criminologists examining various environmental hazards the term "green criminology" (Lynch 1990; South 2014) broadly includes unauthorized acts or omissions subject to criminal prosecution against existing laws protecting society and environment. However, an innovative feature of green criminology has been a further broadening of our understanding of crime, from human to human harm to the natural environment itself, inter alia pollution, wildlife crime, and harm to other species. It is this shift from considering human crime alone to harm against the environment through both legal and illegal means that has distinguished green criminology from other branches of criminology. More recently legislative attention is being given to the criminological aspects of climate change, from the point of view of human contribution to global warming, greenhouse emissions and sea-level rise (Shearing 2015; Zimmerer 2014). At a planetary scale the destruction of the environment is evidence of ecocide. What is amiss, despite the fact that ecocide may be the most destructive form of environmental crimes, is the integration of environmental forensic science in the ecocide debate. This article explores such an interdisciplinary terrain and argues for the inclusion of ecocide studies in forensic science and vice versa. It does so with the aim of raising awareness and interest in both emerging fields of ecocide studies, environmental forensic science and environmental forensic studies (White 2012). Beyond acting in the service of law in litigation proceedings, forensic science is called for the protection the planet from grave harm.

Elements of Crime

The term "Ecocide" originated during the Vietnam War, when the U.S. military combined the chemicals 2,4-D and 2,4,5-T, named the 50:50 mixture Agent Orange, and defoliated approximately five million acres of forests in an attempt to expose communist guerrilla fighters of the Viet Cong (Zierler 2011). Codenamed Operation Ranch Hand, the herbicidal warfare program developed by the military industrial complex targeted entire ecosystems in Vietnam. Outraged by the scale of the destruction and misuse of science, the American scientist Arthur Galston coined the term "ecocide" to describe the weaponization of defoliants at the Conference on War and National Responsibility in Washington, DC (Zierler 2011). The global significance of the term

was brought to a public attention by prime minister Olof Palme of Sweden at the first United Nations Conference on the Human Environment held in Stockholm in 1972. Palme used the term especially with reference to environmental warfare and cross-border pollution. From 1978 until 1998 the United Nations International Law Commission (ILC) had considered criminalizing widespread destruction of the environment as part of a new Code of Crimes Against the Peace and Security of Mankind ("the Code"), and included criminalising environmental destruction in various drafts. Yet by the end of the deliberations, environmental destruction as a stand alone crime was excluded from "the Code," thereafter renamed the Rome Statute (Gauger *et al.* 2012; Short 2016), adopted on 17 July, 1998 and entered into force on 1 July, 2002, the treaty that established the International Criminal Court (ICC) (ICC 1998). As of 2018, 122 states are party to the statute. Founded in 2002, The ICC has the ambitious mandate to prosecute what the Rome Statute recognized as the four "core" international crimes against peace of mankind: genocide, crimes against humanity, war crimes and crimes of aggression (ICC 2011). To date the court has indicted 36 individuals in 21 cases in 8 countries.

There is considerable scope to expand the international protection of the environment through the forum of the ICC. On September 15, 2016, an ICC policy paper on the selection and prioritization of cases for investigation and prosecution expanded its interpretation of crimes against humanity by explicitly mentioning "land-grabs" as a prosecutable environmental crime (The Guardian 2016). According to the policy the ICC would prioritize destruction of the environment, the illegal exploitation of natural resources, or the illegal dispossession of land (ICC 2016). The proposal of a separate law against Ecocide would provide even greater means to individual criminal accountability for serious harm to the natural environment during peacetime within the jurisdiction of the ICC. The ambition is no less than expanding the current framework of international criminal law through a proposed amendment to the Rome Statute introducing ecocide as the fifth crime against peace (Eradicating Ecocide 2015).

The Rome Statute mentions damage to the natural environment once, in the context of war crimes in Article 8(2)(b)(iv). Moreover under the current elements of crime in the Rome Statute, environmental destruction may be understood in anthropocentric terms with criminal liability arising only if human beings are the victims of environmental harm (Drumbl 2000; Smith 2013). Ecological damage itself is not an offence as it does not yet exist as a crime under international law (Higgins 2015). In the earth lawyer Polly Higgins' proposed amendment as a stand alone crime, ecocide has been defined as:

> the extensive, damage, destruction, or loss of ecosystems of a given territory, whether by human agency, or by other causes, to such an extent that that peaceful enjoyment by the inhabitants of that territory has been severely diminished. (Higgins 2015)

Ecocide today is not state crime limited to environmental destruction caused during armed conflict. It also includes ecological damage as a result of corporate activities during peacetime i.e. for the exploitation of natural resources. With regards to defining the

elements of ecocide crime, the *mens rea* (state of mind) standard must be met—though a transnational company might rarely sets out to pollute with the intent of harming the environment—and also the *actus reus*, (the act), that of destroying an ecosystem with recklessness and with the knowledge of the consequences of the action(s). Akin to the legal intention of dolus eventualis (awareness of the likely outcome of an action) Higgins argues that an additional situation in terms of the linkage of the elements of crime and evidence presents itself in the context of climate related ecocide crime. Signing the Paris Agreement within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) accords prior knowledge of duty to limit carbon emissions to state parties (Eradicating Ecocide 2018). Failing to do so, especially on the part of the top carbon emitters, is a potential criminal act.

In describing ecocide as "widespread, long-term or severe," Higgins' definition is markedly different from the conjunctive "widespread, long-term and severe" threshold required in the Rome Statute. The proposed threshold of harm adopts the threshold clauses in the Environmental Modification Convention (ENMOD) to which we will turn to. ENMOD is the international treaty prohibiting the military or other hostile use of environmental modification techniques, opened for Signature on 18 May 1977, entered into force on 5 October 1978 (United Nations 1976). Subsequently it influenced two later international treaties, Articles 35(3) and 55(I) of the Additional Protocol I to the Geneva Convention concerning International armed conflict (United Nations 1977) and Article 8(2)(b)(iv) of the Rome Statute (ICC 1998). Hulme (2004) notes the global outrage over the environmental destruction caused by the US attacks in the Vietnam War was a direct inspiration for the ENMOD convention. Developed exclusively to prohibit the military modification of the environment, the ENMOD convention did not provide direct protection of the environment during armed conflict as did Protocol I, but state parties did attempt to come to an understanding as to what constituted a threshold of harm, namely the disjunctive "widespread, long-term or severe" effects of environmental warfare.

For the committee responsible for the wording of the legal threshold of harm, "widespread" meant an area of about several hundred square kilometers; "long lasting" meant a period of months, approximately a season; while "severe" referred to serious or significant disruption or harm to human life, natural and economic or other assets (Hulme 2004). For commentators, the ENMOD standards, as "technical-legal" terms have remained ambiguous, as opposed to their ordinary meanings that were clearly agreed upon (Ibid). The matter of deciding upon the threshold of harm for ecocide will be deliberated in future negotiations amongst state parties to the Rome Statute. For the purposes of this article, and based on the amendment proposal, the ENMOD standards point to what might be the minimum threefold threshold of harm. To gather and present the spatial, temporal and intensity of each element would be a matter of concern for an environmental forensic investigation.

Environmental Evidence

Environmental Forensic science is a well established and expanding field of forensic science to combat international environmental crimes, such as illegal trading of wild-

life, trans border pollution and waste dumping. In terms of the study of toxicity, environmental forensic science investigations typically deal with identifying the source and age of the contaminating substances and determine the extent of environmental damage over space and time (Mudge 2007). Various methodologies are routinely applied in environmental forensics investigations such as analysis of documentary records, aerial photography, groundwater and sediment analysis, radiocarbon dating, and an array of much more sophisticated methods for capturing the chemical and biological fingerprints of pollutants (Phillips 2014; White 2012). Typically environmental forensic science methods are used in criminal and civil litigation cases, from property damage and toxic torts to testing the boundaries of existing national regulatory frameworks (Petrisor 2014). If the object of environmental forensic science is the study of the traces of criminal activity in the soil, air, water and sediments, then those traces can lead to the crime itself. The same methods and instruments can be applied directly or adapted to suit futureto ecocide crime investigations (Pirrie 2013). Existing and emerging environmental forensics techniques could be crucial tools for establishing new knowledge and practice related to fighting ecocide crime.

One emerging environmental forensic technique is space-borne remote sensing analysis, performed with data acquired by Earth Observation (EO) satellites. Because of its ability to detect landscape change over virtually the entire planet, remote sensing is a technique particularly well-suited to collect spatial evidence on the widespread, long term and severe nature of environmental damage. Generally, the severity or intensity of the impact will be compounded by how widespread or long term the damage is (Hulme 2004). When environmental crimes take place in resource-rich countries with poor human rights records or undergoing conflict, remotely acquired data also reduces risks for victims, witnesses and investigators alike. A discussion of remote sensing is relevant for the present article for three reasons. First, it is recognized as both a human rights investigation and environmental forensics tool (Brills *et al.* 2000; Gargiulo 2016; Kroker 2014; Learner 2013; Núñez 2012; Raymond *et al.* 2014). Second, the author has been involved in a research project that uses spatial analysis and remote sensing methodologies in conducting fact-finding investigations on ecocide crime West Papua conflict, a militarized territory of Indonesia (Alonzo *et al.* 2016). While a discussion of the research project findings is not the aim of this article, it is relevant for the third reason, which is the fact that remote sensing analyses are often performed by independent investigators, such as university researchers, NGOs and human rights organizations as international courts lack the required expertise (Human Rights Center 2012). Operational gaps remain in forensic criminalistic standards and the evidentiary needs of international justice courts (i.e. individual responsibility of offenders) vs. advocacy focus of various non-court actors (Human Rights Center 2012). While currently debated in serious international crime venues such as the ICC, those interested in developing ecocide crime also need to address these salient issues.

Traditionally remote sensing methods have been limited to capturing "snapshots" of facts on the ground, or "before and after" images of dramatic, disturbance events such as fires or land clearance (Kennedy *et al.* 2014). This may suffice for the detection

of singular events but environmental damage often takes place over large spatial and temporal scales causing subtle processes of ecological change. As an example, deforestation not only removes trees but impacts both human and non-humans that depend on them, altering ecosystem qualities. In fact this salient characteristic of environmental harm was recognized in the official negotiations of Article 35 of Protocol I, the 1977 amendment to the Geneva Conventions. State parties deliberating Article 35 at the time had been concerned with means of warfare that were intended to cause "changes to the ecological balance," but this line of reasoning was dropped for the now familiar threefold threshold of harm (Hulme 2004). The Landsat family of satellites co-managed by USGS and NASA have collected the longest-running archive of earth observation imagery available going back to 1972, when the first Landsat satellite was launched. Advances in methodologies such as time series analysis based on the Landsat archive is making it possible more consistent observation of ecosystems (Hansen 2012). The accuracy of time series analysis of changing landscapes depends on the availability of frequent and thus better measurable data (Kennedy *et al.* 2014). This is taking an ecological approach to understanding landscape change in as far as satellite time series analysis shows a temporal record rather than seen as individual satellite images. Long term sustained change detection, such as global warming, forest change, surface water etc. are research subjects for improved understanding of the structure and functioning of the terrestrial ecosystem.

Orbiting Landsat satellites cross every point on earth once every 16 days and collect image and spectral data using a series of sensors currently at 30 meter resolution (30 by 30 meter size pixel). In the media coverage of humanitarian law and human rights investigations, high resolution imagery is often described as the most precise way to collect information from the ground. This may not be the case for environmental crimes where the spatial and durational nature of the violation requires a more nuanced approach. Some large open pit mines can in fact be seen from space where the identity of "perpetrators" is public knowledge. Instead, environmental forensic investigation methods might focus on demonstrating ecological disturbances such as declining vegetation growth in the mining impacted areas over a protracted period of time, taking into account climate variables and phenology. Yet challenges faced by earth observation science may also impact environmental crime scene investigation that uses time series analysis. Just to give one example, atmospheric contamination or noise such as persistent cloud cover, especially in temperate, tropical zones obfuscate the acquisition of cloud free optical imagery. Under such circumstances statistical algorithms for cloud detection that can distinguish between cloudy and clear skies in a given pixel dataset afford a way forward for subsequent analyses such as change detection (Kennedy *et al.* 2010). The application of these concepts and tools to the Landsat image archive could offer fresh insight into the dynamics of ecological crime in more precise terms.

Remote sensing is a complex process that involves data acquisition, calibration, analysis, interpretation, and presentation must meet the evidentiary requirements such as validation, authenticity and chain of custody in a legal context (Kroker 2014). Remote sensing analysis is based on digital data and is therefore digital evidence

(Human Rights Center 2014). Interpretation of satellite imagery poses different technical challenges than those related to digital images or videos. Remote sensing data are often presented as composite digital images that still require an expert witness who is able to explain what is seen and if necessary, demonstrate and authenticate the technical steps that were taken to produce the final image product.

Conclusion

With increasing environmental awareness and scientific knowledge, "the scale of harm required to constitute environmental damage has generally lowered" (Hulme 2004). Case studies analysing various thresholds of environmental harm may help set the standards and interpret legal thresholds of ecocide crime, with increasing crossovers between criminal forensics and traditional scientific research on the environment. There is a vast amount of digital information available in the world today. The proliferation of publicly available earth observation data will only increase the range and accuracy of remotely sensed evidence (Liu 2015).

A fast track towards climate justice is international recognition of widespread destruction of the environment as a serious international crime. However successful prosecution of international crimes require a wide range of probative evidence. Given its traditional expertise in methodologies for detection of contaminants and with new and emerging methodologies, environmental forensic science, can work in an interdisciplinary fashion to help define ecocide crime. Recognising the different goals of international courts and advocacy groups, training provided to non governmental organizations on handling, processing, and chain of custody would improve the reliability and probative value of evidence in combating the crime of ecocide in future legal contexts.

About the author

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