

weather extremes. To quantify these changes, both high atmospheric resolution and large initial-condition ensembles are required.

The attribution community has been using large ensembles to deal with low signal-to-noise problems for over a decade, and their methodology<sup>17</sup> could be directly applied to this climate projection problem. To directly address impact differences between a 1.5 °C and 2 °C world, climate modellers could run large ensembles (>50 members) of ten-year periods for recent observed, and 1.5 °C and 2 °C warmer worlds, using projected changes in sea surface temperatures drawn from existing coupled-model simulations. The use of ten-year time slices would allow for the assessment of long-lived extreme events, such as droughts, while still allowing for large ensembles. The use of >50 ensemble members of a ten-year analysis period should allow for statements to be made regarding policy-relevant return-times such as 50–100 years. The resultant probabilistic assessment of climate would allow for any clear and tangible differences to be detected between small changes in global temperature.

If additional research is not undertaken as a matter of urgency, there is a danger, under the UNFCCC/IPCC timetable, that the 2018 special report will present all the negative economic constraints of achieving 1.5 °C<sup>18</sup> but with insufficient evidence to distinguish between impacts at 1.5 °C and 2 °C of warming, even if very different levels of risk are associated with these two outcomes in reality. The resources required for targeted

'attribution-style' ensembles addressing this question are small relative to the investment planned in CMIP6. The climate research community prides itself on its policy relevance<sup>19</sup>. For once, we have been asked a very specific question, so we need a very good reason indeed not to step up and answer it. □

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## COMMENTARY:

# Criminality and climate change

Rob White

The impacts of climate change imply a conceptualization of environment-related criminality. Criminology can offer insight into the definitions and dynamics of this behaviour, and outline potential areas of redress.

Although there is currently a considerable amount of research on the impact of climate change on environmental and economic systems, there has been less of an emphasis on social systems such as criminal justice. Addressing the social consequences of climate change is central to successful adaptation, and one of the many effects of climate change is transformation in the nature and dynamics of criminality<sup>1</sup>.

New ways of thinking about, categorizing and responding to environment-related crimes have to be developed if we are to adequately address present and future issues.

#### Criminological perspectives

Biophysical changes accompanying climate change have considerable social consequences: the intensive exploitation of non-renewable energy sources; the scarcities

of food and water due to climate-related changes and unsustainable uses of land, oceans and fresh water systems; and the contamination and pollution associated with extraction, production and consumption present serious risks and harms to particular communities. They also provide the context within which criminal and morally corrupt activities involving organized criminal networks, transnational corporations and

governments occur (such as overfishing, water and land theft, and manipulation of energy subsidies), as many of these are linked to the vulnerabilities arising from environmental degradation<sup>2</sup>. Yet, the consequence of such activities contributes to even more ruthless exploitation of planetary resources<sup>3</sup>. Conditions are deteriorating in part due to these illegal and criminal activities, and it is likely that environmentally related crime will simply beget more of the same unless there is concerted response to these activities.

Recent criminological research exploring the nature and dynamics of crime associated with climate change has included examination of the relationship between temperature changes and human behaviour at three levels of analysis: first, individuals — and whether extreme weather conditions, especially heat waves, are related to increases in aggression and thereby criminal violence; second, place-based activities — where the focus is on local weather, indoor/outdoor routines, the specific places where people spend their time and with whom and how this affects their propensity to engage in certain types of crime; and finally, communities and change — consideration of matters such as systemic crop failure, and resultant survival and migration strategies<sup>4–6</sup>. Changes in local weather conditions are seen to affect how people behave psychologically and socially, including participation in activities that may involve poaching and illegal harvesting for the purposes of subsistence.

Analysis of substantive areas of criminality is likewise provided by general strain theory<sup>7</sup>. This work explicates the impact of climate change on crime in terms of factors associated with climate change (such as rising temperatures and sea levels, extreme weather events and food/water shortages) and links these factors to criminogenic mechanisms (such as increased strain, opportunities for crime, and social conflict) that lead to higher levels of individual, group, corporate and state crime.

Specific criminal and environmental offences associated with the phenomenon of climate change are also categorized as: offences that contribute to climate change (for example, unlicensed pollution and the illegal felling of trees); offences arising from its consequences (for example, water theft and wildlife poaching); offences pertaining to civil unrest and organized criminal activities (for example, food riots, migration and people smuggling); and offences of regulation and law enforcement associated with mitigation and adaptation

strategies (for example, carbon trade fraud and regulatory corruption)<sup>8,9</sup>. In this scenario it is anticipated that there will be changes in the type, rate and frequency of offences as the climate alters. Present and future environmental conflicts will largely centre on the allocation and struggle over resources, accompanied by attendant crimes<sup>10</sup>.

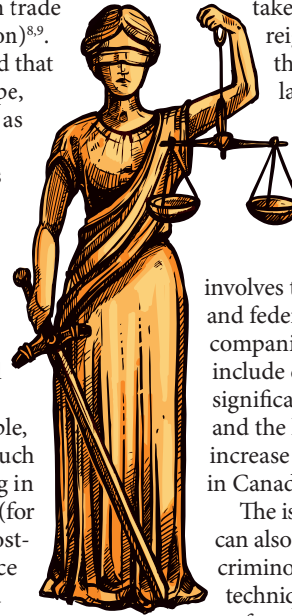
A large and growing body of work is also looking at crimes associated with natural disasters<sup>11–13</sup>. These include crimes pre-disaster (for example, poor construction standards such as omission of steel reinforcing in concrete), during the disaster (for example, looting, rape) and post-disaster (for example, insurance fraud, misappropriation of aid funds and sex trading for aid). The scale of recent disasters indicate additional forms of criminality associated with these events, including the collapse of public order, enforced climate-induced migration and the prevalence of local gang cultures.

### Ecocide and crimes of the powerful

The destruction of the environment in ways that differentially, unequally and universally affect humans, ecosystems and nonhuman species can be conceptualized as a specific type of crime. The concept of ecocide refers to the extensive damage, destruction to (or loss of) ecosystems of a given territory resulting from human actions (or omissions)<sup>14</sup>. In essence, dominant forms of production and consumption, particularly in the affluent western countries, become part of a taken-for-granted common sense — the experiences and habits of everyday life (for example, high meat consumption, reliance upon private petroleum-based automobiles) — that fundamentally contribute to global warming, and thus ecocide<sup>15</sup>.

Recent criminological work highlights the fact that the key perpetrators and responders to global warming tend to be one and the same: namely, nation-states and transnational corporations, both of which are primarily concerned with maintaining the economic status quo<sup>16</sup>. Globally, there is widespread state support for business that contributes to global warming such as the oil and coal industries<sup>17</sup>.

Climate change is rapidly and radically altering the basis of world ecology, yet very little substantive action is being



taken by states or corporations to reign in the worst contributors to the problem. Placed within the larger global context of climate change, the scale and impact of the Alberta tar sands project, for example, fits neatly with the concept of ecocide as well as the concept of state-corporate crime<sup>18</sup>. This project involves the collusion of both provincial and federal governments with big oil companies, and the consequent harms include destruction of vast areas of forest, significant water and land contamination, and the largest contribution to the increase of global warming pollution in Canada<sup>19,20</sup>.

The issue of state/corporate collusion can also be examined through the criminological lens that focuses on techniques of neutralization<sup>21</sup>. This refers to the ways in which business and state leaders join together in attempts to prevent action being taken on climate change. Work done on the politics of climate change in the United States, for example, has demonstrated close connections between business and government culminating in a form of state-corporate contrarianism<sup>22</sup>. It has been observed that the essential stumbling blocks to any type of progressive or concrete response to climate change include: downplaying that global warming is caused by human activity; blocking efforts to mitigate greenhouse gas emissions; excluding progressive, ecologically just adaptations to climate change from the political arena; and responding to the social conflicts that arise from climate change by transforming societies into fortress states that exclude the rest of the world<sup>23</sup>. The net result is no action or inaction in addressing the key factors contributing to climate change, such as carbon emissions<sup>24</sup>.

### Climate change and crime prevention

In addition to exposition of the links between climate change and crime types, and the crimes of the powerful in regards to global warming, criminological work has also provided insight into potential areas of redress. For example, work on greening justice has explored how the institutions of criminal justice can themselves be transformed in ways that diminish carbon emissions (such as through use of alternative energy sources and energy efficient buildings and vehicles) and how offender rehabilitation can be directed toward ecologically beneficial projects (such as tree planting and community gardens)<sup>25</sup>.

Courts, police and environmental protection agencies are crucial actors in responding to climate change, as are



emerging environmental enforcement networks<sup>26</sup>. For instance, environment courts have been applying sanctions designed to repair environmental harm as well as punish offenders<sup>27</sup>. How issues pertaining to climate justice are conceptualized and institutionally addressed have major implications for the ways in which justice and governance are constructed at a practical level<sup>28</sup>. This includes the larger question of weighing up whether the future is to be one of ecocide or survival. One of criminology's tasks is to ensure that right choices are made.

Responding to climate change will necessarily involve situational crime prevention techniques as well as theoretically informed responses to corporate and state crime. A key lesson from conventional crime prevention is that it ought to be based on a problem-solving model of intervention. A wide range of strategies and interventions across many institutional domains will need to be deployed<sup>29</sup>. This includes, for example, what has been learned from previous work on bushfire arson and how to prevent it<sup>30</sup>.

Addressing potential climate-related crimes has implications for criminal

law reform, policy development within criminal justice agencies, and contemporary environmental management practices. Future criminological initiatives need to revolve around prediction and prevention and, as part of this, to devise a typology of climate change related crimes that reference diverse situations, settings, offenders and offences. □

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