Situational Crime Prevent and the Ecological Regulation of Green Crime: A Review and Discussion

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Abstract

 Situational crime prevention theory suggests the need for innovative, non-punitive, non-criminal justice polices to control crime. That approach has not been widely employed by criminologists to address the control of environmental crimes. Within criminology, such studies have most often been undertakenby conservation criminologists, while green criminologists have undertaken empirical studies illustrating the ineffectiveness of more traditional, punitive responses to environmental or green crimes. Numerous examples of innovative environmental social control practices can be found outside of the criminological literature. Here, we briefly review the use of situational crime prevention theory and research by conservation criminologists, and provide examples of non-punitive environmental social control policies used throughout various nations to illustrate how they are consistent with situational crime prevention arguments. We also note that research and theory in other disciplines suggest that crime is produced by larger structural forces, in particular the structure of the global capitalist world system and treadmill of production, indicating that situational crime prevention alone is likely not sufficient to control environmental crime.

**Introduction**

Criminologists have suggested moving away from coercive social control responses to crime to more flexible situational crime prevention (SCP) approaches. SCP approaches embrace non-criminal justice social control alternatives to combat crimes. One of the areas within criminology where SCP approaches are relevant, and often overlooked, draws attention to environmental crimes, and within criminology is found in the green and conservation criminology literatures. Some of that literature examines environmental social control (ESC), though many examples of ESC are found in literatures outside of criminology. BY ESC we mean various strategies states employ to control/limit crimes against or the destruction of ecosystems and their inhabitants. Forms of ESC vary, through many are consistent with SCP. Consistent with SCP argument, many ESC do not operate through criminal justice processes, and do not employ traditional coercive social control to generate deterrence. Non-criminal justice ESC may include, for example, economic policies and development programs that use incentives to minimize ecologicaldestruction and disorganization.

The ESC literature is complex to the extent that it includes numerous examples of relevant policies that can be interpreted as consistent with SCP approaches. Many ESC policies have not, however, been empirically or appropriately evaluated, making it difficult to render conclusions concerning the efficacy of those approaches for controlling ecological destruction/disorganization/green crimes. Also, as noted, ESC responses to green crimes are complex because they include a variety of non-criminal justice responses, again making them difficult to summarize.

To examine the intersection between ESC and SCP, we begin with some brief background on situational crime prevention. We then examine conservation criminology which is the area within criminology where SCP strategies havebeen most likely to have been evaluated. We then provide several examples of non-criminal justice ESC-SCP policies (multilevel governance, REDD+, payments for environmental services), practical examples of those policies (controlling the market for Rhino horns), and a case study of Periyer Preserve that illustrates several ways SCP concerns have been incorporated into ESC programs and policies. We then discuss the effectiveness of ESC policy, and review criticisms of ESC-SCP approaches. Finally, we examine how the political economic structure of global capitalism generates ecological destruction, and how that destruction might be controlled with policies such as steady state economics. These latter ideas are discussed to illustrate the need for unusual solutions to ecological destruction.

**Background**

 Numerous criminologists suggest the use of situational crime prevention (SCP) as a method for controlling crime (Freilich and Newman, 2016). Those arguments promote the idea that non-criminal justice responses may be better suited for controlling crime. Non-criminal justice environmental social control (ESC) include many examples of SCP assumptions. The following sections review several different ESC strategies with SCP implications that have not been adequately addressed in the extant green/conservation criminology literature.

 As Newman (2012) argued, promoting SCP requires attending to the definition of crime, which is also an important issue when discussing ecological harms as crimes. Traditionally, criminologists employ a legal definition of crime, a focus that tends to exclude ecological “crimes” because those behaviors are typically outside the criminal law (e.g., defined in regulatory, administrative and civil laws; Lynch, Stretesky and Long, 2015a). Thus, in studying ESC, researchers must first be aware that the behaviors being examined are non-traditional crimes ordinarily ignored by criminologists. Green crimes (or harms) come in many different forms, and some are legal and some illegal. The green criminological literature is based on concept of ecological disorganization that is emphasized within environmental sociology and developed within ecological Marxism. We therefore conceptualize ecological disorganization as legal and illegal actions that cause harm to ecosystems in the pursuit of the objectives of capitalism (Lynch et al. 2013).

As an example of SCP related to ESC (ESC-SCP), Newman (2012) discusses the control of carbon emissions, which green criminologists use as an example of an ecological harm not currently defined as crime (Kramer, 2013; Lynch, Burns and Stretesky, 2010; Lynch and Stretesky, 2010). Green/conservation criminologists provide other examples of deleterious non-criminal environmental behaviors which we cannot describe in detail such as: the idea that the production of ecological disorganization is a crime (Lynch et al., 2013); defining environmental injustice as a crime (Lynch, Stretesky and Long, 2015b); and toxic state-corporate crimes (Ruggiero and South, 2013).

Today numerous nations have entered into agreements/treaties to control ecological harms because the consequences of those harms threaten the existence of ecosystems and many species (including humans, Scott, 2015). Studies by physical scientists contribute to identifying those harms (e.g., studies of planetary boundaries, Steffen et al., 2015), providing information about the kinds of deleterious ecological behaviors that require control, which also influences global ESC policies. This often results in ESC policies that exist outside the criminal justice system. However, many ESC policies also use more traditional regulatory control strategies. One of the problems researchers must acknowledge when employing examples from the ESC literatureis that not all ESC’s work very well, asdiscussed below.

 As Freilich and Newman’s (2016) argue, SCP focuses on “minutely analyzing” a specific crime to explain how “situational factors facilitate a crime’s commission, which...informs the social control response in ways that allow the situational causes of the crime to be manipulated and changed to enhance social control”. That emphasis has a long tradition within criminology influenced by Clarke’s (1983) situational crime prevention approach. Clarke’s has also applied SCP to the analyses of environmental crimes such as poaching and illegal fishing. These studies are reviewed briefly below.

**Situational Crime Prevention and Conservation Criminology**

Clarke’s SCP informs conservation criminological research, and has generated several empirical studies. Those studies examine CRAVED models (Clarke, 1999) or its variants, with CRAVED being shorthand for identifying items that are attractive targets for offenders, or those that are concealable, removable, available, valuable, enjoyable and disposable. It is beyond the scope of this paper to review specifics of those studies. Those studies general apply CRAVED-based models. Pires and Clarke (2012, 2011; Clarke and Rolf, 2013; Pires and Petrossian, 2016) applied CRAVED analysis to parrot poaching, while Petrossian and Clarke (2009, 2014; Petrossian, 2015; Petrossian, Marteache and Viollaz, 2015; Petrossian, Weis and Pires, 2015; Marteacche, Viollaz and Petrossian, 2015) applied this model to illegal, unreported and unregulated fishing (see, Lemieux and Clarke, 2009, on elephant poaching). For the present discussion, what is important about these studies is that they tend to support CRAVED analysis.

As Pires and Clarke (2011: 125) noted, however, because CRAVED models include situational factors, no single test of a CRAVED model “constitute[s] a definitive test of its validity. Only an accumulation of the results of applying CRAVED to a range of different theft offenses, involving different targets in different contexts, could allow a judgment to be made about its validity and the relative importance of its separate dimensions.” This caution suggests the need for additional ESC-SCP analyses. Consistent with Pires and Clarkes’ cautionary statement, across studies cited above, the specific situational factors that apply to crimes against wildlife vary. As examples, Petrossian and Clarke (2014) found that the number of ports available for disposing of illegally caught fish include factors related to concealability, removability, availability, value, enjoyability, and disposability of fish species. In their study of parrot poaching, Pires and Clarke (2011) found evidence that compared to un-poached birds, poached parrots were more available and removable, but not more valuable, disposable or enjoyable. The differences between these studies illustrate why Pires and Clarke’s warn about too few CRAVED studies.

While space precludes examining these studies, and none produces the same result, they are tied together by the following generalization: situation-specific factors matter when it comes to identifying conditions that produce environmental harms/crimes. This general finding implies that there will never be a “one-size-fits-all” ESC-SPC policy. That means that ESC-SPC policies must be flexible, a point illustrated by several ESC approaches reviewed below that have been described more fully in literatures outside of criminology and which employ non-coercive social control mechanisms.

**Multilevel Governance and the Environment**

 Multilevel governance theory (MGT) emerged to address understanding governance relationships between nations and international regulatory bodies, and has particular relevance to international ESC, which often involves multilevel governance (MLG). In MLG, a key challenge is integrating supranational policy into national and local government policy. As a result, MLG-ESC policies must allow local governments to craft and apply ESC policies in ways that reflect the local, situational context, an argument consistent with SCP theory (Yang, Rounsevell and Haggett, 2015).

Consistent with SCP arguments, MLG-ESC policy emphasizes “ecological rationality” (Lundqvist 2004) which includes undertaking cost-benefit analysis. This can be a complex problem, since the benefits and costs involve measuring/quantifying both ecological harms and the benefits of reducing those harms (e.g., what is the financial benefit of increasing species richness in an ecosystem?). Consistent with traditional criminological arguments like deterrence, cost-benefit models also address whether there is a reduction in offending. While there are numerous criticisms of that approach (Sen 1977), those critiques suggest that situational factors impact decision making, making it difficult to generalize from any particular study – a point consistent with Pires and Clarke’s earlier cautionary statement. Sen’s criticism appears to enhance the idea of SCP policy since it draws attention to situational factors.

 There are numerous examples of MLG-ESC policy which address: cooperative supranational climate change policy (Betsill and Bulkeley 2006); forestation/deforestation policies (Bottazzi and Dao 2013); decentralization of energy infrastructures (Goldthau 2014); water recycling (Hughes 2013); governance of marine ecosystems (Gruby and Basurto 2013); and forest management practices (Bixler 2014), among others. These policies vary significantly due to the MLG argument that local governance must be allowed to adapt supranational policy to local contexts to improve their efficiency (Yang, Rounsevell and Haggett, 2015).This approach is employed because local or community level governments are closest to the manifestation of the problem being addressed, and thus better able to recognize how that problem plays out within the context of their community, and supports the SCP suggestion that a “one-size-fits-all” ESC policy may not be the most effective response to environmental harms. That situation, however, makes it difficult to review MLG-ESC policies because they are implemented in very different ways in different national and local contexts. Unfortunately, not only are there no relevant criminological studies of MLG-ESC policies, the broader MLG literature contains only a handful of relevant studies, which usually involve case studies (Thompson 2013). Thus, there is currently a lack of empirical studies of the effectiveness of MLG-ESC policies. This situation needs to change and additional MLG-ESC studies are necessary to determining how effective these approaches are in preventing the displacement of ecological disorganization.

**REDD+ Policies**

 Criminologists have made limited reference to REDD+ policies – or Reducing Emissions from Deforestation and Forest Degradation policies – despite their widespread use across nations (Martin and Walters 2013). The goal of REDD+ is to prevent and reverse deforestation, which has a significant effect on climate change. Two broad types of policies are included: those that limit deforestation and those that promote afforestation/reforestation. Both policies are necessary for addressing the immediate and long terms effects of deforestation on climate change. By preserving and reforesting lands, these policies also contribute to improved water management, the prevention of flooding and soil erosion, and fisheries and biodiversity preservation.

 REDD+ policies are widely supported by the United Nationsthrough the UN Framework Convention on Climate Change (UNFCCC). In 2007, UNFCCC requested studies addressing the effect of deforestations and conservation projects on climate change (the “Bali Action Plan”) and at various UN *Conferences on Climate Change* (COP). COP policies require REDD+ approaches to address situational factors existing within nations, the development of assessment plans, and to outline ways to include both local communities and Indigenous People in monitoring and implementing REDD+ projects. COP 16 added the use of incentives to facilitate REDD+ policies. At COP 19, the “Warsaw Framework on REDD-Plus” was adopted which included a provision that developing countries could qualify for financial support for REDD+ polices from the UNFCC’s *Green Climate Fund* once they demonstrated positive results from REDD+ policy applications. Funds for those programs come from developed nations, forcing them to pay for adverse ecological consequences associated with excessive ecological consumption, and to provide incentives for developing nations to engage in ESC. The Warsaw provision created conditions for REDD+ policies, but few methodologically sound evaluations exist (Sills et al. 2017).

With respect to SCP, REDD+ provides examples of non-criminal justice ESC applied to prevent ecological harms, and policies which promote the use of incentives rather than punishments to control environmental destruction. In this sense, REDD+ and ESC-SCP strategies overlap. It is beyond the scope of the present discussion to review the wide variety of REDD+ programs that have been implemented (see, Cerbu, Swallow and Thompson 2011; Swallow and Goddard 2013). While numerous studies suggest how REDD+ policies can be implemented (Angelsen and Rudel 2013), and evaluated (Herold and Skutsch 2011), and describe the limitations of “first generation” of REDD+ policies (Murdiyarso et al. 2012), few empirical studies of REDD+ exist. This is an emerging area of research to which criminologists can contribute employing SCP theory from conservation criminology as suggested by Clarke and associates.

**Innovative, Non-Criminal Justice Environmental Social Control Strategies**

 As noted, SCP suggests the need for innovative, non-criminal ESC strategies. Below, we review examples of innovative ESC policies that also illustrate SCP principles.

 ***Controlling the Rhino Horn Market****.* Nations have promoted numerous policies to reduce illegal animal trade and poaching. Some, such as China’s use of bear farming to replace illegally harvested bear gall bladders used in traditional Chinese medicine, are controversial due to abusive conditions at those facilities (Livingstone and Shepherd, 2016). Nevertheless, there is hope that animal farming alternatives can protect animals from poaching. Here, we focus on animal farming related to the protection of Rhinoceros as one example.

Many Rhino species are critically endangered and require protection to survive in the wild. Rhinos populations are found in only eight nations, and about 95% have disappeared since 1900. The World Wildlife Fund estimates that Rhino poaching has increased by 9,000% since 2007. Rhinos are poached for their horns which cost more than an ounce of gold or cocaine. Thus, there is extensive motivation to engage in Rhino poaching. Some suggest that Rhino farming can produce a source for Rhino horns (through dehorning) to protect Rhinos from poaching while also treating Rhinos humanely. Can such a strategy work?

Economists Bulte and Damania (2005) address that question by estimating the effects of various theoretical economic models of Rhino farming on Rhinoceros poaching. These models have limitations because theyare hypothetical. Interestingly, Bulte and Damania found that Rhino farming could either protect Rhinos through a substitution (farmed Rhino horns replace wild Rhino horns) and price effect, or expand Rhino poaching under certain situation specific contexts. In the latter case, one could suggest that application of situation specific ESC-SCP might be used to overcome those situational factors.

Some question Rhino farming due to humanitarian concerns. While it is currently illegal to trade Rhino horn globally, South African Rhino farmer, John Hume has been building his Rhino herd (he has more 1,260 Rhinos, and a Rhino breeding program) and humanely dehorns and cares for Rhinos with a large veterinarian staff, awaiting legislation that would allow the legal trade in farmed Rhino horns. He hopes to flood the market with legal Rhino horn, driving down the price of Rhino horn thereby discouraging Rhino poaching. He estimates he has humanly collected 5 *tons of Rhino horn, which he stores in a bank vault.*

***Dyeing Rhino Horns****.* Another interesting solution to Rhino poaching implemented by the *Rhino Rescue Project* in 2011, is dying the horns of wild Rhinos pink with a solution that is harmful to humans, but has no effect on Rhinos. Injected Rhinos must be re-treated every four years. The idea behind these injections is to devalue the treated horns and provide disincentives for poaching (Ferreira et al., 2014), which also reduces the opportunity for poaching, an outcome consistent with SCP.

 There is some controversy surrounding this method. While the Rhino Rescue Projects reports that only 1.7% of treated Rhino (4 of 230 treated Rhinos) have been poached since 2011, other’s question its utility. Ferreira et al. (2014) report that Rhinos with treated horns in the Sabi Sand Nature Reserve where much less likely to be poached than untreated Rhinos in nearby areas (3 versus 37 Rhinos over 10 months). They nevertheless argued that the treatment program does not act as a general deterrent because it has no effect for untreated Rhinos.

From the brief discussion above, it is clear that there is some hope for these inventive, alternative ESC-SCP policies. Not all ESC policies have fared so well however, and in the next section we provide an example of one such policy.

**Payments for Environmental/Ecosystem Services (PES).**

Widely promoted, payments for environmental/ecosystem services (PES) policies have been employed to minimize the loss of natural habitat, prevent deforestation and ecosystem fragmentation, and to encourage habitat preservation. The idea is simple and involves non-criminal justice policy consistent with SCP principles. PES are market-based mechanism for land conservation that promote environmental stewardship through payments to land holders who preserve ecologically sensitive land (Engel, Pagiola and Wunder, 2008; Wunder, Engel, and Pagiola, 2008). These policies are endorsed by the UN, which identifies twenty-four PES related programs in its *Millennium Ecosystem Assessment* Report (2005), and by the *Cato Institute* and the *Property and Environmental Research Center*as mechanisms for privatizing environmental protection by providing incentives for individuals to act as environmental stewards.

 Much of the PES literature is theoretical and employs case studies, and few studies address the effectiveness of PES policies (Mahanty, Suich and Tacconi, 2013; Pattanayak, Wunder and Ferraro, 2010). Arriagada et al., (2008)analyzed the effect of a PES farm deforestation programin Costa Rica, an area well recognized for implementing PES programs. They compared forest cover over time on PES-participating and non-participating farms. PES-farms had 11-17% more forest cover at the end of the study than non-PES farms. However, in our view, methodological and interpretive limitations of this study suggest these PES programs failed. When examined more critically, the data indicates that both PES and non-PES farms *lost forest coverage during the study*, suggesting PES did not actually prevent deforestation, but rather slowed deforestation. In terms of more traditional studies of crime displacement, this intervention could be interpreted as a partially successful outcome. That is, Guerette and Bowers (2009:1331) suggest that in some instances enforcement interventions appear worthwhile if the “spatial displacement effect is less than the treatment effect.” Despite this more optimistic view, we suggest that deforestation is a *complex international problem* promoted by international trade in the capitalist market place and cannot necessarily be addressed by local or situational policies. We address this issue in greater detail in the section on political economy, the environment and social control.

In a meta-analysis, Pattanayak, Wunder and Ferraro (2010) assessed whether PES programs provide beneficial environmental services. They argue that PES programs, by providing environmental subsidies, can theoretically promote an “optimal supply” of environmental services. Their data was based on prior case studies and several quasi-experiments addressing PES effectiveness. Over all, their analysis suggested that while government sponsored PES forest program produce modest to no gain in restricting deforestation, privately funded PES forest programs performed better. It should be noted, however, that the data on privately funded PES forest programs came from case studies rather than quasi-experiments, and as the authors suggest, because of this, can’t rule out alternative explanations for forest preservation.

Several concerns have been raised about PES/REDD+ programs as summarized by Phelps, Webb and Arawal (2010). They note that PES/REDD+ programs pose considerable financial investment and monitoring costs that make those program prohibitive to smaller nations and for small or poor land holders. This situation, they suggests, promotes centralized state land holdings, which they note further marginalized Indigenous people by exerting state control of their lands, and denying them customary access to the ecological services those forests have long provided. However, under certain situational conditions, they note that PES/REDD+ policies can promote increased land evaluations of forests as carbon sinks, increasing the value of Indigenous lands when those lands are not centralized under state control.

**The Periyar Reserve, an example of SCP?**

 **T**his section provides a case study of ESC in the Periyer Reserve (aka, the Periyar National Park and Wildlife Sanctuaryor Tekkady) in India. It illustrates many SCP-consistent, non-criminal justice ESC policies that address reducing opportunities and motivations for poaching by local peoples by providing benefits to local peoples to act as ecosystem stewards.

Today, Periyer Reserveconsists of 135 square miles (350 square kilometers) of land (about the size of Philadelphia or Las Vegas), and is home to a diverse array of wildlife species Including24 Bengal Tigers (for species see www.periyartigerreserve.org). The park has received numerous awards for its environmental preservation achievements.Below, we describe some SCP consistent ESC policies employed in the park since the late 1990s.

 In 1998, the India Eco-Development Project (IEDP) introduced new park management policies funded by the World Bank to encourage ecological preservation (Mathew and Kuriakose 2015). A unique aspect of those programs were efforts to respect the cultures of the indigenous people who inhabit the area. Six tribal groups live in Periyar (Chaudhuri 2012), and one IEDP program goal was to get them involved in park management and preservation. Consultants for the program (environmental experts, environmental activists, sustainable development NGOs, social scientists, and hospitality and tourism professionals, Chaudhuri 2013)contributed ideas that broaden the kinds of ESC strategies that were implemented.

The IEDP introduced market-based “livelihood” training to area residents, decentralized park management and encouraged local control over new programs to provide residents a stake in those programs. Also included were income generatingecologically sustainable “self-help” projects such as producing souvenirs for park tourists from native plants (Chaudhuri 2013). Many, however,were unsuccessful.

Several Indigenous women formed the “Vasanthaseans,” or guardians of the springs, which used voluntary patrols to surveil illegal activities, including poaching (Chaudhuri 2013). This program was quite popular, and by 2007 included 90 volunteers (Chaudhuri 2013). Indigenous youth formed two eco-tourist organizations, the ‘Tribal Trackers,” and the “Heritage Trackers.” Park official believe these tour groups not only provide employment, but additional security and surveillance against poaching. Other locally managed programs include an eco-tourism hotel and guided tours lead by local residents.

The Forest Department introduced “livelihood programs” to provide training to Indigenous people to lessen their dependence on park resources (Chaudhuri 2013), including “micro-enterprise development” (Mathew and Kuriakose 2015). Also introduced were “micro-specific” biodiversity management plans based on localized ecosystem needs. Broader ecological regulations, such as a ban on fishing, were introduced. To accommodate the needs of Indigenous people called the “fisherfolk,” those regulations were modified to allow fisherfolk to continue to fish, but only for nonnative fish species.

Park officials also introduced a “social fencing” program that used armed patrols to replace physical fencing. Social fencing practices encourage collective responsibility for protecting the park, and reduced wildlife and Sandalwood poaching (Chaudhuri 2013; for other programs, see http://www.periyartigerreserve.org/ ecotourism\_activities.php).

Perhaps the most interesting outcome of these ESC projects was that a group of Sandalwood poachers decided among themselves that they should join the project. The poachers reached out to a local NGO for help to facilitate their plan (Kutty and Nair, ND). The Forest Department allowed the poachers to voluntarily patrol the Reserve for a year while they were observed and assessed. After this trial period, twenty former poaches were selected to serves as guards, guides and community trackers. Thirteen “rehabilitated” ex-poachers are employed as tiger guides who, according to the Reverse’s *Tiger Trail* website, expose hikers to “unusual and strange stories of the former poachers, now your guides and protectors of the forest” (http://www.periyartigertrail.in/programme.html).

As noted, this case study illustrates how an effective ESC-SCP program might develop. Doing so is no small task. But as this example illustrates, Periyer Reserve programs are consistent SCP philosophy.

**Traditional ESC Environmental Crime Responses and their Effectiveness**

Often, ESC employs more traditional and punitive criminal justice responses designed to achieve deterrence or compliance with environmental regulations. Assessments of those approaches are rare within criminology. Interestingly, while criminological studies find that environmental enforcement rarely achieves significant deterrent effects, economists often reach the opposite conclusion (Gray and Shimshack 2011), perhaps due to different focus that leads to alternative methodological procedures and study designs. This may be partly due to alternative domain assumptions about what is to be deterred. Specifically, it is important to keep in mind that green criminologists draw upon ecological Marxist approaches that are compatible with Foster, Clark and York’s (2010) arguments concerning the Jevon’s Paradox. That is, increasing resource efficiency may increase (not decrease) resource use. In this case, it is not increased efficiency increases resource use, rather changes in environmental laws that lead to more pollution and resource extraction. In other words, green criminologists suggest that laws may improve environmental compliance in individual cases as found in the economics literature, but do relatively little to alter overall levels of ecological disorganization. In addition, economic studies tend to show very large effects for punishments despite the fact that the number of those penalties and the fines associated with those penalties are, on average, quite small (see summary in Gray and Shimshack 2011: 7-10). For example, Deily and Gray (2007) found that EPA enforcement actions increased compliance by 32-33%. If this was indeed true, it would be quite a simple matter to eliminate noncompliance with environmental regulations – the probability of enforcement and punishment would simply need to be increased. Green criminologists have generally approached studies differently and this could lead to different conclusions that enforcement does not significantly enhance compliance (see below), and have questioned whether weak compliance responses can cause the level of deterrence economic studies suggest. For example, Lynch et al. (2016) estimated the probabilities of criminal punishment for violations of US environmental regulations. The found the probability of punishment was quite small– in the US, on average, there were only about 35 criminal sanctions a year from 1983-2013, yielding a criminal conviction probability of only 8.6 per 100 million cases across all laws enforced by US EPA. Based on those probabilities, Lynch et al. question whether these few cases can promote broad scale deterrence. Other empirical studies of environmental enforcement by green criminologists also fail to find substantial effects for civil, administrative or criminal penalties against oil, coal and chemical companies (Long et al., 2012; Stretesky and Lynch, 2011; Stretesky, Long and Lynch, 2013b). By inference, such studies suggest the need for more effective ESC approaches. It is possible that innovative ESC policies consistent with SCP assumptions might be useful alternatives.

One alternative to traditional social control is argued to occur through “modernization,” or the use of non-coercive, innovative policies and technology forcing standards (ie., laws that require certain kinds of pollution controls; Spaargaren and Mol 1993) as ESC. These strategies are used by the US EPA in its self-policingor self-audit program. EPA’s self-policing policy allows corporations to self-report environmental violations in exchange for reduced penalties. Empirical studies of self-policing by green criminologists find that these policies are ineffective, and that companies enrolled in the program tend to report smaller or technical violations rather than serious environmental crimes (Stretesky, 2006; Stretesky and Lynch, 2009). We refer to these studies briefly because they indicate that more traditional and even innovative ESC enforcement policies have little impact, suggesting the need for new alternatives. However, in deciding what ESC should look like, it is also necessary to consider factors that might limit the utility of ESC-SPC policies, an issue that is addressed below.

**Critiquing SCP-ESC Policy**

Huisman and Erp (2013) pose several criticisms of SCP related to the control of environmental harms. Importantly, they suggest that SCP’s focus on the immediate context of environmental harms ignores how larger social, political and economic forces produce environmental harms and affect responses to those crimes (Huisman and Erp 2013:1178). For instance, market pressures can have a much larger impact on a firm’s level of ecological withdrawals and additions than the threat of inspections that place limits on those activities. Illustrating that large scale economic and political factors affect ecological disorganization, Shandra, Shor and London (2008) found that a nation’s international debt and industrial exports affected the extent of water pollution for fifty developing nations during the 1990s. This result suggests the need for ESC policies that have economic dimensions.

Environmental sociology and ecological Marxism examines how the global economic context impacts environmental harms and their distribution across nations, and how the organization of the international capitalist treadmill of production generates opportunities for environmental harms, and shifts environmental harms across nations (Pellow, 2007). Several empirical studies support this contention (e.g., Jorgenson, 2010; Jorgenson, Dick and Austin, 2010; Jorgenson, Austin and Dick, 2009). Some of those studies, however, also found situational effects. For example, examining the effect of foreign direct investment (FDI) on water pollution in a sample of less developed nations, Jorgenson (2009) found that the deleterious effect of FDI was modified in nations with higher concentrations of non-government environmental organizations, perhaps indicating that NGOs can play a role in ESC-SPC policy implementation.

The limited critique of ESC-SPC policies within green criminology suggest the need to consider how the global political economy structures environmental harms and their production. We address this argument briefly below.

**Political Economy, the Environmental and Social Control**

 Environmental sociologists/ecological Marxists argue that environmental harm and capitalism intersect, and green criminologists have explored how these arguments relate to the production and control of green crimes (Stretesky, Long and Lynch, 2013a). The main propositions behind that argument come from Schnaiberg’s (1980) treadmill of production theory and various theoretical discussions developed by Foster (1992, 2002).

 In Schnaiberg’s view, ecological harms in post-WWII capitalism are generated by what he calls the treadmill of production (ToP). In the ToP, capitalists accelerated production by relying heavily on fossil fuel and chemical labor to extract raw materials (called ecological withdrawals) and to process them into commodities, which also generates an increase in pollution (called ecological additions). Taken together, ecological withdrawals and additions accelerate the pace of ecological disorganization or the destruction of the global and local ecosystems, and as green criminologists have argued, generate green crimes (Lynch et al. 2013). Numerous empirical studies have supported these contentions (see studies by Jorgenson).

 Building on Marx, Foster states that these ecologically deleterious outcomes occur because capitalism and nature are “in contradiction” with one another. Foster and other ecological Marxists analyze how the expansion of capitalism requires using up nature, and how accelerating capitalism must result in the expanded destruction of nature. Others have extended this idea using metabolic rift theory (Burkett and Foster 2006; Foster 2009; Foster, Clark and York, 2010) and unequal ecological exchange theory (see studies by Jorgenson in references).These arguments and empirical analyses posit that the global capitalist ToP organizes production and ecological disorganization patterns across nations. To take those arguments into account, ESC-SPC polices would need to address how global economic organization can be restructured to control ecological disorganization (see below).Such approaches must go beyond traditional criminal justice penalty models. As empirical studies by green criminologists suggest, coercive penalty responses (e.g., fines) do not change the ToP (Stretesky, Long and Lynch, 2013b;Stretesky and Lynch, 2011). Why not? Because ecological disorganization is produced by the normal operation of capitalism, a position supported by environmental sociologist, Richard York (2004: 358) who argued that enforcement actions against ToP actors do not pose a “serious counter-force” to the normal operation and expansion of the ToP. That argument, when coupled with Schnaiberg’s and Foster’s observations, suggest the need for economic policies to constrain the expansion of the ToP and therefore reduce ecological disorganization. These kinds of economic policies could potentially fit with SCP approaches, assuming that policy makers also pay attention to the need to take theory and research by environmental sociologists and ecological Marxists into account – which may be unlikely due to ideological reasons.

 Before environmental sociologists/ecological Marxist proposed that structural factors generated ecological disorganization, similar observations were suggested in the 1970s by Herman Daly, a former World Bank economist. Daly is the most prominent proponent of “steady state economics,” the idea that centralized state control of economic production is required to limit economic growth in order to eliminatethe adverse ecological impacts associated with unconstrained economic growth (Daly 1973, 1996). Daly, along with Costanza (Costanza et al., 2014) have detailed the components of a steady state economy. Steady state economics is based on the observation that economic production has physical limits imposed by the quantity of the ecosystemavailable for consumption in sustainable ways. In that view, the ecosystem can only provide a limited quantity of resources for production, and only has limited capacity to absorb the pollution (both toxic and heat pollution) production generates. Those limits began to become visible during the industrial revolution as expanded production consumedextensive quantities of nature and generated extensive pollution. More recently, environmental scientists led by Johan Rockstrom, chemist, Will Steffen, atmospheric physicist and former head of NASA’s Goddard Institute for Space Studies, James Hanson, and, among others, Noble Prize winning atmospheric chemist, Paul Crutzen, have charted these physical limits of the earth’s ecosystem using planetary boundary analysis. These scientists have identified nine physical limits to earth’s ecosystem, and measured which one’s have been crossed, and how close the others are to being crossed. These studies indicate the need for concerted, international cooperation to limit the effects of economic expansion, industrial production and pollution on the global ecosystem, and support the need for steady-state economic ESC policies.

Exactly how nations would cooperate to create a global steady state economy is a difficult problem. For example, in implementing steady state economies globally, it would be necessary to limit and possibly reverse economic expansion in highly developed nations while at the same time allowing growth in developing/underdeveloped economies to enhance global economic equality and access to other desirable outcomes (e.g., increased standards of living, health care, food and housing). At the global level another problem is that developed nations often oppose and undermine such agreements (e.g., the US and Canada and the Kyoto Protocol on climate change). Costanza et al. (2014) and Daly (1991, 1996) have developed plans for these alternative ESC policies, which await implementation by the nations of the world. Theseare examples of alternative ESC policies that address the relationship between excessive, uncontrolled economic development and ecological destruction, and potentially possess SCP implications.

**Conclusion**

Policies consistent with SCP have, as illustrated, been applied in efforts to constrain a variety of adverse ecological consequences. Those policies have not been widely addressed in the criminological literature. Much of the available literature within criminology has been generated by conservation criminologists. Conservation criminologists have assessed how SCP relates to a small portion of wildlife crimes. Green criminologists have contributed to the study of ESC by examining the effectiveness of more traditional forms of ESC that typically employ punishments, but also through studies of non-punitive, non-criminal justice alternative such as the US EPA’s self-audit policy. Empirical studies by green criminologists suggest that coercive ESC policies often fail to achieve their desired outcomes. Considered along-side the results of conservation criminological studies, these empirical studies suggest that SCP may be an appropriate methods for controlling environmental crime. Due to the limited number of studies of ESC-SCP, however, it is difficult to reach definitive conclusions concerning the effectiveness of such programs. Thus, continued attention needs to be devoted to studying ESC-SCP interventions to expand the research base in this area, noting which efforts appear most promising.

In addition, despite supporting evidence from conservation criminologists, critics of ESC-SPC modelsnote that environmental harms are not solely caused by situational factors, and require broader economic policies to address. Consistent with that argument, environmental sociologists/ecological Marxists have explored how the global capitalist treadmill of production generates opportunities and motivations for ecologically destructive behaviors. Steady state economists make a similar claim, and note the need for broad-scale economic policies that constrain economic growth as a solution to ecologically destructive behaviors. In practical terms, ESC-SCP models cannot solve the contradictions of capitalism that lead to ecological disorganization. However, until a different economic system emerges ESC-SCP researchers could direct more efforts at discovering ways in which successful local intervention and treatment efforts could be modified, scaled up or be simultaneously applied elsewhere to minimize the displacement of ecological disorganization in the short term. At the same time, there is a need to better examine MLG-ESC policies that are implemented to address ecological disorganization on a large scale.

In short, criminologists have not paid significant attention to the SCP argument that non-coercive ESC can be effective in regulating ecological destruction. As we suggest, that observation indicates the need for additional studies of ESP-ESC policies by criminologists. Given the state of the world’s ecosystem, the need for such studies is pressing.

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