The Treadmill of Production, Planetary Boundaries and Green Criminology

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Introduction

Criminologists rarely examine the effects of state enforcement mechanisms on the overall trends in toxic releases. This is surprising because the overall goal of environmental regulation regimes *should be* to prevent or reduce environmental harm in general. This harm reduction might occur through a variety of mechanisms including some form of specific or general deterrence, where the punishment of environmental violators would help reduce toxic releases in general. Moreover, we would expect that if a regulatory regime were effective there would be a negative correlation between large penalties and general toxic releases that would limit the global expansion of environmental damage.

While the issue of punishment and toxic releases is neglected within criminology more generally, the development of green criminology has drawn greater attention to issues of environmental enforcement, whether environmental enforcement efforts limit environmental damage, and whether environmental enforcement patterns are equitable or are unevenly distributed across communities in relation to their class, racial and ethnic composition (Stretesky and Lynch 1999, 2002, 2009*a*, 2011; Lynch, Stretesky, and Burns 2004*a*, 2004*b*; Stretesky 2006, 2008; Long et al. 2012; Stretesky, Long, and Lynch 2013*a*). While green criminologists have drawn attention to the effects of environmental enforcement and the efficiency of those responses they have largely drawn on the environmental justice literature and more orthodox criminological studies of the effects of penalties on environmental compliance as a means of situating those studies (Lynch, Stretesky, and Burns 2004*a*). In this chapter we break from that tradition and expand upon the kinds of theories that have been employed in green criminology to examine environmental enforcement patterns and results by addressing treadmill of production (ToP) theory as developed by Schnaiberg (1980).

ToP theory analyzes environmental harm from a political economic perspective. The treadmill disrupts the ecology through ecological withdrawals or the extraction of raw materials used in production and through ecological additions that are produced in the manufacturing process through pollution that is added to the environment. In the present work we focus attention on ecological additions associated with manufacturing. We argue that as toxic releases increase they are more likely to create the potential for harm to humans and non-human species. We also argue that as more toxins are released into the environment, the more likely it is that ecosystems that rely on that environment are to be disrupted. Toxic releases may disrupt ecosystems by altering the nature of those systems in a way that negatively impacts biodiversity and species' health by threatening the equilibrium of the ecosystem and its ability to reproduce the conditions for life. An example of the large-scale effects of ecological additions related to carbon dioxide pollution can be seen in the form of ecological disorganization commonly referred to as climate change.

Due to the tremendous scale of ecological disorganization that is currently occurring, we argue that criminologists must focus on the broad problem of planetary boundaries as opposed to compliance with some particular regulation (see Rockström et al. 2009*a*; 2009*b*). Planetary boundaries can be described as the nine environmental thresholds that if crossed, could have catastrophic repercussions for the planet. Focusing on ecological disorganization and threats to the biosphere in general by referencing planetary boundaries is much more important for green criminologists than observing, for example, whether a company complies with a U.S. governmental environmental regulation such as the Clean Water Act (CWA). We emphasize that it is entirely possible to comply with the CWA even as we destroy the biosphere. This disturbing condition occurs because harm to ecosystems is not synonymous with violations of environmental law.

In our view, we are drawn to the political economic orientation of ToP theory because we see that orientation as compatible with the forms of political economic analysis some green criminologists have taken up in the study of environmental harm and environmental social control (Lynch 1990; Long et al., 2012) and other related harm and theoretical issues (Lynch and Stretesky 2003; Stretesky and Lynch 2009*b*). At the same time, our interest in ToP theory is related to our observation that political economic explanations of environmental harm have been underdeveloped within green crime, especially in relation to the use of this approach in other disciplines (e.g., Boyce 2002). In our view, ToP theory offers one method for extending the use of political economic theory within green criminology.

In the sections that follow, we review ToP theory and its connection to green criminology. We then review the nine planetary boundaries, with particular emphasis on two, climate change and chemical pollution. Next, we present data on indicators of climate change and chemical pollution, and United States environmental enforcement. We conclude by situating the data within the ToP and argue for a green criminological focus on ecological disorganization.

Treadmill of Production

We begin with the observation that treadmill of production theory has had an important influence on the analysis of environmental harms within the field of environmental sociology, especially within the United States (Buttel 2004). It has also had an impact on various varieties of ecological Marxism, and is consistent with the preference for political economic explanation taken in that approach (O’Connor 1998; Foster 2002; Burkett 2007). As noted, this preference for political economic explanations of green crimes and patterns of justice and injustice sits well with some varieties of green criminology. To make this point and to clarify the content of ToP approaches, we review the core general and specific assumptions of ToP approaches below.

General Assumptions

The basis of ToP theory was proposed by Schnaiberg (1980). ToP theory is based on a political economic understanding of capitalism in which two issues become central to Schnaiberg's depiction of the intersection of capitalism and environmental crisis. The first is the internal mechanism of expansion. Capitalism is driven by constant efforts to expand production, and capitalism must expand to accelerate the generation of profit (for extended discussions of capitalist expansion and the environment see Foster, Clark, and York 2010). That expansionist tendency is the treadmill of production, a process that is constantly in motion, and constantly seeking expansion. Thus, 'treadmill of production' refers to a political economic system characterized by the continued expansion of 'industrial production, economic development as well as increasing consumption' (Gould, Schnaiberg, and Weinberg 1996, p. 5).

The expansionary tendencies of capitalism place it in direct conflict and opposition with the natural world or the ecological order (Foster 2002; Burkett 2007). In order to expand constantly, capitalism requires raw material inputs. Those inputs must be extracted from nature. Thus, as capitalism expands, its consumption of natural resources also expands, accelerating with its expansion the destruction of nature (Foster 2002; Burkett 2007). Because the world is finite, so are the raw materials in the world, and capitalism's constant expansionary tendencies can be seen as being inherently contradictory to the preservation and health of the ecological system. In ToP theory, the effects of capitalist expansion on the destruction of nature through the consumption of raw material for productive purposes is defined by the term 'ecological withdrawals.'

In addition to ecological withdrawals, capitalism produces expanding ecological harm through ecological additions. Ecological additions include the waste products of production, and are composed of an array of polluting outcomes that include waste materials, harmful pollutants, and toxic waste. Ecological additions have two important impacts. First, these chemicals can disrupt processes in the natural world and affect the health of the ecological system (Balmford and Bond 2005). A widely cited example is climate change, which is an outcome of ecological additions that force warming and change the equilibrium of the entire ecological system (Lovelock 2007). Second, ecological additions cause environmental toxins to accumulate in the environment. Those toxins create biologically disruptive forces that impact the health and morbidity of the various species that inhabit ecosystems.

Taken together, capitalism's continuous expansion of ecological withdrawals and ecological additions challenges the health of the ecosystem, and forces large-scale transformations in the ecosystem. When combined, those large-scale transformations of the ecosystem, which can vary from one geographic location to the next in quality and quantity, cause what ToP refers to as ecological disorganization – or the disruption of the natural order and mechanisms of the ecological system. At this point, this general description of capitalism addresses how the capitalist treadmill of production tends to generate ecological disorganization. Schnaiberg's theory, however, is not a general theory of capitalism, but was specifically designed to address the relationship between capitalism and ecological disorganization that occurred following World War II, or in the modern era of monopoly capitalism and its association with chemically intensive production practices.

Chemically Assisted Production

According to treadmill theorists, ecological disorganization intensified after World War

II, and was tied directly to the expansion of chemically assisted production technology (Gould, Pellow, and Schnaiberg 2008). A number of these new technologies were an outgrowth of war-related technological discoveries and many were based on the manipulation of fossil fuels into new materials for production and that were used in production.

These new chemical technologies of production played a role in both the withdrawal of raw materials and the process of producing commodities. From a capitalist standpoint, these new technologies were highly valued since they promoted economic growth and the escalation of profit by reducing the costs of production. Energy-intensive chemical technology allowed workers to produce considerably more, leading to declining commodity prices, which in turn stimulated demand for commodities and for the natural resources needed to make those products. For these investments in the new methods of production and extraction to pay off, production must increase (for criticisms see Foster 2005). As a result, both the volume and the toxicity of waste being released into the environment increased (Gould, Pellow, and Schnaiberg 2008). In this way, the modern ToP tends to increase environmental problems by 'expanding resource consumption and waste emissions' (York 2004, p. 355).

New Dimensions of Conflict

Political economic theories typically address conflict from the perspective of class conflict. ToP theory expands the concept of conflict by focusing attention on the forms of political and social conflict that emerges around efforts to protect and contain the treadmill of production. As a result, ToP identifies the state, labor and capital as three groups that impact the treadmill. In addition, some treadmill theorists include the public and social movements (Gould, Schnaiberg, and Weinberg 1996; see also, Bonds 2007; Stretesky, Long and Lynch 2013*b*).

In theory, the state, labor, and capital all assert that economic growth is critical for social well-being (Obach 2004). Capital supports increasing production for the purpose of expanding profit; labor's interests relates to increased wages and job growth assumed to accompany increased levels of manufacturing; for the state, expanded economic development generates additional revenue. Thus, these various actors often work together to adopt policies that advance production. Although conflicts among these actors exist, at some level each subscribes to the economic logic of the expansion of production and to the ideological belief that expanded production will advance public welfare. As treadmill theorists note, there is little evidence supporting the connection between public welfare and economic expansion (Gould, Pellow, and Schnaiberg 2008). Moreover, as ToP suggests, increases in production and productivity tend to undermine the interests of labor in the long run, since, consistent with Marx's analysis of capitalism, the acceleration of chemically assisted production reduces the need for human labor and lowers wages (Schnaiberg 1980).

For purposes of the current discussion, we draw attention to the state. ToP suggests that the state, though influenced by the ToP, is also relatively autonomous. As an autonomous entity, the state also has an interest in maintaining its legitimacy with the general public. To do so, the state must demonstrate a commitment to protecting the public from large-scale harms such as ecological disorganization. As a result, the state sometimes engages in efforts to control, slow or even reverse the treadmill of production when its effects are clearly detrimental to public and environmental health. We examine this possibility further below.

The Role of Enforcement in the Treadmill

As noted, in the modern ToP, chemical-intensive production is an important cause of ecological disorganization. Chemically intensive production also expands social disorganization by expanding ecological withdrawals and additions. These effects will often be overlooked since the treadmill actors typically privilege economic expansion over the effects of production on ecological disorganization. Nevertheless, as the ToP expands, its ecologically disorganizing effects become more and more apparent. These effects can be seen in dramatic ecological disasters related to the treadmill of production's ecologically disorganizing effects (e.g., Love Canal; deadly smog; Bhopal; the proliferation of toxic waste sites). In such circumstances, the state must act to impose external constraints on production to limit its ecological disorganization impacts. In some cases, the state may only take these actions if pressured by the public (Gould, Schnaiberg and Weinberg 1996).

Given its public responsibilities and its connection to the ToP, the state plays opposing roles in influencing the treadmill. Sometimes, the state makes environmental concessions to non-corporate actors to maintain the legitimacy of the treadmill and the state (Obach 2004; Bonds 2007). As a result of being response to citizen concerns, the state sometimes slows the speed of the treadmill (Schnaiberg 1980; Gould, Pellow, and Schnaiberg 2008). When ecologically destructive behaviors of the treadmill become extreme and obvious, the state must make larger concessions to protect the public such as creating broad environmental regulations. Unfortunately these concessions are as likely to be symbolic as they are to protect the environment. Nevertheless, environmental regulations create a routine means through which the state can potentially influence the speed of the treadmill of production and its impacts on the ecology.

Environmental regulations contain a variety of mechanisms for constraining the ToP. These include enforcement tools such as cease and desist orders, the permitting and monitoring of toxic and polluting emissions, and the use of financial penalties used in an effort to force compliance with environmental regulations. In theory, financial penalties ought to impact corporate behaviors since they possess the ability to impact profit making and, when large and public enough, can send a message that bad environmental behavior will not be tolerated (Stretesky 2006). Again, evidence on the effectiveness of penalties in controlling environmental violations is mixed. In some cases, penalties may not be sufficient to alter the behavior of corporations since they do not affect their bottom line.

On this point, York (2004, p. 358) notes that environmental enforcement is influenced by the interests of the treadmill of production, and consequently fines are 'not a serious counter-force' to the treadmill. For instance, Stretesky, Long and Lynch (2013*a*), using a ToP framework, found that monetary penalties levied against corporations by the EPA for various pollution violations, had no effect in reducing the level of toxic releases by those companies. Additionally, in a study of waste disposal in Germany and the Czech Republic, Vail (2007) discovered that illegal waste simply moves across borders in response to state-imposed regulations when those regulation are not uniform across locations. More generally, Gould, Pellow, and Schnaiberg (2008) suggest that despite increased state environmental regulations, the treadmill has not contracted. Thus, while treadmill theorists support state-centered solutions to ecological disorganization, they simultaneously claim that there is little evidence that the state is effective in reducing environmental disorganization.

Due to the apparent lack of ability or desire by the state in the United States to meaningfully reduce the amount of ecological disorganization that is created, we question whether assessing compliance with state-created, socially influenced environmental regulations is the best framework for studying green crime. Instead we recommend examining the impact of environmental withdrawals and additions on planetary boundaries.

Planetary Boundaries, the Treadmill of Production and Green Criminology

Rockström et al. (2009*a*, p.472) have identified nine "planetary boundaries," which, "define the safe operating space for humanity with respect to the Earth's system and are associated with the planet's biophysical subsystems or processes." Identification of these boundaries comes in response to the earth moving from the Holocene era, a time of relative stability, to the post-Industrial Revolution Anthropocene era, where humans have become the major force driving environmental change. The boundaries include: 1) climate change, 2) nitrogen/phosphorus cycle, 3) biodiversity loss, 4) ocean acidification, 5) stratospheric ozone depletion, 6) global freshwater use, 7) changes in land use, 8) atmospheric aerosol loading, and 9) chemical pollution. In order to maintain the climate conditions of the Holocene era, roughly the last 10-12,000 years, Rockström et al. (2009*a*) argue that these nine boundaries need to remain under certain levels (see also Magdoff and Foster 2011, p. 13), or risk cataclysmic environmental changes that could have horrendous effects on humans, non-human animals and the entire planet.

The planetary boundaries are relevant in this case because, as we argue elsewhere (see Stretesky, Long and Lynch 2013*b*), orthodox definitions of environmental crime are social constructions based on politically influenced power relations. A political economy approach, informed by the ToP, to defining green crime recognizes that powerful actors in society create laws and these laws do not significantly reduce ecological disorganization. Rather, orthodox approaches to green criminology often rely on whether or not a company violates an EPA statute like the Clean Air Act or Clean Water Act (Winter and May 2001; Stretesky 2006; Burby and Paterson 2007). Studies of this nature are problematic because they may find that companies are complying with EPA statutes, however, they are still releasing environmental additions at alarming rates. A focus on planetary boundary indicators as outcome measures, rather than whether a company adheres to laws subject to manipulation by politicians and corporations, would provide a much more accurate picture of the damage that is being done by the ecological disorganization created by the ToP.

In this chapter we focus on two planetary boundaries, climate change and chemical pollution. We choose these two boundaries because of the presence of both ecological additions and enforcement data, however all planetary boundaries should be examined by green criminologists because, "protecting the planet requires that we attend to all of these planetary boundaries, and others not yet determined (Foster, Clark, and York 2010, p.17). According to Rockström et al. (2009*a*), the planetary boundary for climate change has already been reached. It is measured by two indicators 1) atmospheric carbon dioxide (CO^2) concentration, and 2) change in radiative forcing. (Rockström et al. 2009*a*, p.473). There are many repercussions of climate change including loss of polar ice sheets, regional climate disruptions, loss of glacial freshwater supplies, and pole-ward shift of subtropical regions, among others (Rockström et al. 2009*b*).

On the other hand, the planetary boundary level of chemical pollution has yet to be determined, primarily because it is impossible to measure the effects of all chemicals that have been released into the environment. "By current estimates, there are 80,000 to 100,000 chemicals on the global market…[s]ome toxicity data exist for a few thousand of these chemicals, but there is virtually no knowledge of their combined effects" (Rockström et al. 2009*b*, p.32). It is difficult to determine the planetary boundary of chemical pollution because of the sheer magnitude of chemicals released into the atmosphere. The results of chemical pollution on the planet include 1) "through a global, ubiquitous impact on the physiological development and demography of humans and other organisms with ultimate impacts on ecosystem functioning and structure"

(Rockström et al. 2009*b*, p.32), and 2) interaction effects with other planetary boundaries including climate change and biodiversity loss.

We argue that in order to determine whether the state is helping to substantially reduce ecological disorganization created by the expansionary nature of capitalism, a ToP informed green criminological framework should be employed that focuses on slowing the march toward planetary boundaries. We now present data on environmental additions (CO^2 emissions and Toxic Release Inventory [TRI]) and contrast them with levels of environmental enforcement in the United States.

Trends in Environmental Additions and Environmental Enforcement

Table 1 reports data on two measures of environmental additions, first US and World CO^2 emissions measured in kilotons and metric tons per capita for the years 2002–2011. Second, we also present the total EPA TRI figures measured in pounds for the same time frame. TRI contains information on the disposal and release of nearly 650 toxic chemicals in the United States (for further details on the TRI see, Burns, Lynch, and Stretesky 2008). The TRI data represent a measure of total reported chemical releases in metric tons per year for each company for air emissions, surface water discharges, underground injections, and releases to land by year. These toxic releases measure the overall level of ecological disorganization created by each company annually. The TRI figures reported in Table 1 are the sum total of all company reported toxic releases for that year.

[Insert Table 1 About Here]

An examination of the trends in US and CO^2 emission is illuminating. The first point that is readily apparent is the difference is overall size of the US CO^2 emissions compared with the figures for the entire world. Over the ten-year span, the average US value was 18.8 metric tons per capita, while the average value for the entire world was 4.6. During those years, the United States released over four times the amount of carbon dioxide into the atmosphere compared to the world. Clearly, environmental additions are not released equally throughout the globe. If we look at the total overall CO^2 releases measured in kilotons, emissions in the United States have decreased roughly 10% from 2002 to 2011; however global CO^2 releases have increased 25% over the same time frame. These trends are consistent with the ToP. Overall global ecological disorganization is increasing, while a shift in environmental additions from the Global North to the South is simultaneously occurring. Table 2 reports that civil/administrative penalties for violations of EPA air statutes generally trends upward, with the exception of 2011. However, as noted earlier, a small reduction in US emissions masks the real problem of moving towards and past the planetary boundary of climate change.

[Insert Table 2 About Here]

Trends in TRI data also provide information about environmental additions and the impact of the state's response to chemical pollution. Table 1 shows that total TRI values decreased between 2002 and 2009, however, they began to increase in 2010 and 2011, so it is unclear what direction these values will move in the future. It should be noted that TRI data is self-reported by companies and it is likely that the actual values of toxic releases into the environment are greater than what is reported to the EPA.

If we examine the years that we have civil/administrative violations (Table 2) and criminal prosecutions (Table 3) data for (2008–2011), there is a 5% increase in the total TRI value, while there was a 41% increase in total civil/administrative penalty amount (measured in US$), a 44% increase in the total number of violations, and a 53% increase in the number of criminal prosecutions. Over that four year span, environmental additions measured by TRI increased, while the three measures of environmental enforcement also increased. Although this is a short time frame, it shows that the United States' current approach to enforcement does not appear to effectively *reduce* chemical pollution in any meaningful way.

[Insert Table 3 About Here]

To be sure, there are numerous criticisms that can be levied against our brief presentation of the environmental additions and enforcement data, such as the short time frame of the data presented (we were limited by the availability of EPA compliance data), and it is possible that for deterrence to truly work, we would need to examine environmental additions data far into the future to give the deterrent aspect of enforcement time to work. However, in our opinion, these arguments are moot. A brief look at Tables 1 shows that environmental additions, if there are decreasing are not doing so to a degree that will help reduce the possibility of reaching (in the case of chemical pollution) or returning to (in the case of climate change) the planet boundaries. Tables 2 and 3 show that in most cases civil/administrative EPA penalties are increasing, while the number of EPA criminal prosecutions vary a great deal from year to year. In sum, in the case of the United States, the state's approach to reducing ecological disorganization is not working; rather the ToP continues to treat nature and the planet as an expendable resource, without concern for the future repercussions of its actions.

Discussion and Conclusion

Treadmill theory emerged to explain the causes of ecological disorganization. Despite its importance in other disciplines, this explanation of ecological disorganization has not been applied widely within criminology (see, Long et al. 2012). We suggest that this is a surprising omission, especially within green criminology, given the origins of that view in political economic theory and the obvious connections between green criminological political economic positions and the political economic origins of ToP.

The orthodox criminological literature has long argued that large penalties should alter the behavior of rational actors. Moreover, that position has been widely adopted as a model for controlling environmental crime by regulatory agencies. In contrast, ToP theory argues that ecological disorganization is driven by the nature of capitalist production and the inherent contradictions and conflict between capitalism and nature (Foster 2002). In that view, since the systemic properties of the system drive ecological disorganization, it is unlikely that financial penalties will affect the polluting behavior of corporations since fines do not change the basic nature of the capitalist system of production.

The data on environmental additions and enforcement that we presented appear to reject the orthodox criminological position and provide some support for ToP arguments. These data leave open the argument that the efforts of the state to control ecological disorganization are more likely to represent legitimation efforts than to represent real attempts to control social disorganization (Barclay, Schmidt, and Hill 1980; Marshall and Goldstein 2006; Bond 2007; Gould, Pellow, and Schnaiberg 2008). Bond (2007, p. 159), for instance, reports that state 'environmental reviews [that are supposed to protect the environment] are typically used in a way that is conducive to the expansion of production.' Thus, environmental enforcement, including the use of penalties, may be a legitimation tool that increases levels of state trust, reduces state autonomy, and expands rather than reduces production and ecological disorganization (York 2004). Because the state can use environmental enforcement as a legitimation tool, we argue that it is better for green criminologists to focus on the effects of environmental withdrawals and additions on planetary boundaries. The planetary boundaries represent a much more valid measure of ecological disorganization, than state level environmental regulations.

Ecological disorganization is a serious issue that should attract greater criminological attention, especially with respect to the process of social control, an issue that has been widely studied in criminology with respect to street crime. Criminology, however, has often excluded the examination of the problem of controlling corporate and environmental crime, and when it does address this issue, it is typically examined in relation to deterrence theory. Evidence on the deterrent value of penalties is generally mixed at best (Stretesky 2006; Ariel 2012; Prechel and Zheng 2012), and those mixed results indicate that deterrence arguments ought to be rejected (Paternoster 2010).

These findings raise a larger question that is central to ToP approaches. Rather than social control, it is the nature of the system of production that generates ecological disorganization. Thus, the remedy is to reconfigure the system of production to prevent the typical forms of ecological disorganization capitalism creates. Studies conducted outside the United States report similar observations and conclusion (Vail 2007).

Whether these green crimes involve forms of ecological disorganization related to timber crimes, wildlife crimes, mountaintop mining, hydrofracturing, or to ecological additions and withdrawals, there is reason to begin to addresses these crimes in relation to broader political economic theories of green harms, and specifically in relations to view such as those offered in ToP approaches.

Consistent with our results and ToP arguments, we suggest that it is not the structure of penalties or the nature of social control that ought to receive the attention of green criminologists who examine the control of green harms. Rather, it is the structure of the system of production and its relationship to ecological disorganization that deserves greater attention from green criminologists. ToP theory presents one way of accomplishing that task.

There is significant evidence of ecological disorganization in a variety of forms in the contemporary world. Green criminologists need to begin to contemplate how the dispersion and occurrence of these forms of ecological disorganization are related to explanations for these behaviors that span the national and situational contexts in which these harms are committed. That animals are abused, that wildlife is trafficked, that deforestation, climate change and pollution occur are all serious issues. Indeed, these outcomes are changing the very world in which we live. The issue is what lies behind the broad scope of these behaviors, and whether green criminology can explain these forms of harm collectively rather than individually. It is, for example, one thing to describe environmental atrocities or violence against animals. It is quite another to locate the forces that connect these problems. In our view, a political economic approach to green criminology continues to hold out the best method for understanding the wide-spread appearance and dispersion of green crimes across the nations of the world in an era in which the world's economy and the economies of individual nations are dominated by the capitalist world system.

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Table 1. US and World CO^2 Emissions and TRI Values, 2002-2011

	CO^2 Emissions (US)[a]		CO^2 Emissions (World)[a]		
Year	kt	Metric tons per capita	kt	Metric tons per capita	Total TRI (lbs.)[b]
2002	5,650,957	19.6	25,661,666	4.1	4,774,130,320
2003	5,681,664	19.6	27,212,807	4.3	4,468,288,838
2004	5,790,761	19.8	28,646,604	4.5	4,231,287,236
2005	5,826,393	19.7	29,724,702	4.6	4,358,983,455
2006	5,737,615	19.2	30,700,124	4.7	4,327,118,860
2007	5,828,696	19.3	31,433,524	4.7	4,123,355,536
2008	5,656,838	18.6	32,155,923	4.8	3,875,380,211
2009	5,299,563	17.3	32,042,246	4.7	3,392,594,741
2010	5,120,926	17.3	32,099,085	4.7	3,785,152,724
2011	5,031,608	17.2	32,127,504	4.8	4,086,529,225

Notes: [a] The values of CO^2 emissions for US and World in 2010 and 2011 are estimates. Total TRI includes total on and off site disposal and other releases for all chemicals and industries.

Table 2. EPA Civil & Administrative Enforcement of Air, Water, and Hazardous Waste Violations, 2008-2011

	Air		Water		Hazardous Waste		Total[b]	
Year	Total Number	Total Penalty	Total Number	Total Penalty	Total Number	Total Penalty	Total Number	Total Penalty
2008[a]	1,211	$46,136,135	1,082	$351,803,943	799	$20,174,602	3,092	$418,114,680
2009	1,241	$125,254,551	1,322	$62,403,017	806	$24,790,511	3,369	$212,448,079
2010	1,911	$172,953,421	1,395	$131,559,343	823	$44,723,902	4,129	$349,236,666
2011	1,536	$147,663,413	2,254	$416,947,457	654	$25,690,945	4,444	$590,301,815

Note: [a] All 2008 values are actually the average values of the 2007 and 2008 enforcement cycles, due to limitations in the data availability for those years. [b] The values in the total column are the sums of the air, water and hazardous waste columns.

Table 3. Number of EPA Criminal Prosecutions, 2002-2011[a]

Year	Total Prosecutions[b]
2002	51
2003	130
2004	73
2005	85
2006	133
2007	108
2008	57
2009	79
2010	99
2011	121

Note: [a] Fiscal years, not calendar Years. [b] Total prosecutions for violations of all EPA statutes.