



A Comprehensive Application of Rational Choice Theory: How Costs Imposed by, and Benefits Derived from, the U.S. Federal Government Affect Incidents Perpetrated by the Radical Eco-Movement

Jennifer Varriale Carson¹ · Laura Dugan² · Sue-Ming Yang³

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Abstract

Objectives In this study, we examine the effect of both the costs and benefits of perpetration, along with the rewards of abstention, on the behavior of a uniquely rational, yet frequent perpetrator of ideologically-motivated crime: the radical eco-movement.

Methods We combine data on U.S. federal government actions and incidents perpetrated by the radical eco-movement to assess multiple components of rational choice theory. Our investigation employs Granger causality and autoregressive Poisson analyses.

Results As a whole, we find that what the government does seems to influence the behavior of the radical eco-movement; namely, when government behaviors increase the costs of perpetration, eco-incidents decline. Further, we find partial evidence that raising the marginal benefit of perpetration is associated with more incidents.

Conclusions Theorizing as to why such nuanced findings were discovered, we conclude that the decision-making process of the radical eco-movement is more complex than originally anticipated.

Keywords Rational choice theory · Eco-movement · Counterterrorism · Terrorism

Introduction

Scholars have oft contended that rational choice theory (RCT) is too constraining to human nature and inapplicable to broader, more criminogenic populations (DeHaan and Jaco 2003; Pratt et al. 2006). These criticisms are unsurprising, given that much of the

The authorship is ordered alphabetically, as all authors have contributed equally to this work.

✉ Jennifer Varriale Carson
jcarson@ucmo.edu

¹ Department of Criminal Justice, University of Central Missouri, Warrensburg, MO, USA

² Department of Criminology and Criminal Justice, University of Maryland, College Park, MD, USA

³ Department of Criminology, Law, and Society, George Mason University, Fairfax, VA, USA

scholarship in this area is almost exclusively limited to the cost side of the risk-reward calculation. Although much has been learned from this focused research (Chiricos and Waldo 1970; Cochran and Chamlin 2000; Pridemore and Freilich 2007; Sherman and Berk 1984; Tittle and Rowe 1974), more recent scholarship by Loughran et al. (2016) maintains that valid RCT tests must also consider the benefits gained from illicit behavior. This is an especially important consideration for the perpetrators of terrorism, defined here as “the threatened or actual use of illegal force and violence to attain a political, economic, religious, or social goal through fear, coercion, or intimidation” (LaFree and Dugan 2007:184), as their motives typically go well beyond personal gain. In fact, terrorists often justify their actions as part of the greater good, leading to political, economic, religious, or social freedoms of a repressed population (LaFree and Dugan 2007), demonstrating the salience of the benefits side of RCT in their decision-making.

Despite the likely importance of benefits in terrorists’ decision-making calculus, research in this area has also largely failed to incorporate this construct (Dugan et al. 2005; LaFree et al. 2009); although the notable exceptions have demonstrated the importance of how terrorists perceive rewards (Perry and Hasisi 2015). Other work has extended benefits to include those associated with abstaining from terrorism (Dugan and Chenoweth 2012) and found that conciliation directed toward Palestinians has been more effective than that of punitive actions. Such findings suggest that when governments only consider punishment-based counterterrorism strategies and ignore the potential for rewarding good behavior, opportunities to reduce violence can be lost.

The current research follows the recommendation of Loughran et al. (2016: 23) to “evolve beyond the somewhat narrow, current focus on costs and risk and bridge into deeper study of offending rewards and motivation.” We do so by applying Becker’s (1968) delineation of rational choice theory to explain the behavior of environmental and animal right extremists; a frequent, yet uniquely rational, perpetrator of ideologically-motivated illegal activity in the U.S. As the goals of radical eco-extremists include broad-based protections for the environment and animals, we assess how changes in the marginal benefit of perpetration (measured by increases and decreases in U.S. environmental protections) affect their behavior. In addition, we follow Dugan and Chenoweth’s (2012) model by including a carrot-based approach that rewards the abstention of illegal activity, along with more traditional measures of punishment (i.e., a stick approach). Also following Dugan and Chenoweth’s strategy, we evaluate these relationships through monthly time series of activity within the U.S., based on the premise that individual perpetrators are part of a broader movement that seek to change legislation in order to protect the environment and/or animals. We also test for mutual effects, allowing for us to examine whether the eco-movement’s activity also affects government behavior. Overall, we find that what the government does appear to influence the behavior of the radical eco-movement, but in more complex ways than initially anticipated.

Rational Choice Theory

The oft cited philosophers Beccaria (1764) and Bentham (1789), with their discussions of utility and proportionality, established the framework upon which modern RCT is based. The crux of contemporary iterations of RCT, based on this philosophy and developed from Cornish’s (with Clarke 1986) and Becker’s (1968) formulations, is the notion of a rational, self-interested actor engaging in a risk-reward calculation. In theory, and at its

most parsimonious, when the latter consideration outweighs the former, the behavior in question will occur. In other words, an individual's behavior is based on their perception of the expected utility of a given act, and when that expected utility of acting rises above its costs, that individual will engage in said act.

Perhaps given its Classical School origins, rational choice-based research has long focused on the risk-side of this calculation and has been erroneously convoluted with deterrence theory (Loughran et al. 2016). As such, past work has primarily evaluated the role of punitive sanctions on the inhibition of criminal activity through either objective deterrence investigations (Chiricos and Waldo 1970; Gibbs 1968; Tittle 1969; Tittle and Rowe 1974) or individual-level perception studies (Erickson et al. 1977; Jensen et al. 1978; Waldo and Chiricos 1972). This line of research has explored the effects of a myriad of policies within policing (Sherman and Berk 1984; Sherman and Weisburd 1995), sentencing (Cochran and Chamlin 2000; Kovandzic et al. 2004) and more recently, counterterrorism (Dugan et al. 2005; LaFree et al. 2009; Pridemore and Freilich 2007; Carson 2014; Yang and Jen 2017). In sum, this literature suggests that increasing the certainty of punishment is the most effective deterrent of criminal behavior. However, its effects are less clear when evaluating counterterrorism policies, as studies have discovered that deterrence efforts may be ineffective and can sometimes even exacerbate terrorist violence (e.g., LaFree et al. 2009).

In their recent contribution, Loughran et al. (2016) attempted to remedy the almost exclusionary focus¹ on punitive sanctions by returning to Becker's (1968) original formulation of the theory. Specifically, Loughran et al. (2016) argue that valid tests of RCT should include measures for: (1) the probability of detection, (2) the sanction's severity, and (3) benefits obtained from committing the act. These scholars found that indeed, benefits had a more pronounced effect on behavior than that of costs, paralleling results in the terrorism literature (Hamm 2004; Kruglanski et al. 2009; Perry and Hasisi 2015).

Applying Rational Choice Theory to Terrorism

RCT offers an especially appealing lens through which to observe terrorist behavior as terrorism typically involves a great deal of planning, suggesting that its perpetrators are rational agents who consider the costs and benefits of their decisions (LaFree and Ackerman 2009; Smith et al. 2008). In fact, Clarke and Newman (2006) argue that any differences between terrorism and crime are of "marginal importance," as both depend on the coupling of motivation and opportunity.

But as rational choice-related research in crime has suffered from a predominantly singular concentration on the latter of these constructs, so too has the literature examining terrorism. This may be due to the difficulty in uncovering rewards, which would typically require scholars to conduct perception-based studies of terrorists or possible terrorists—a population that is less accessible than criminals. In addition, recent efforts to evaluate "what works" in counterterrorism have mostly assessed the effectiveness of stick measures, such as military interventions (Enders et al. 1990; Enders and Sandler 2000; LaFree et al. 2009), targeted killing and leader decapitation (Fisher and Becker 2019; Hepworth 2014; Johnston 2012; Jordan 2009; Mannes 2008), house demolitions (Efraim et al. 2010) and legislated punishment

¹ While this piece is explicitly designed to counter RCT's dissidents, other scholarship has also evaluated the effects of benefit perceptions (Matsueda et al. 2006; Piliavin et al. 1986; Uggen and Thompson 2003) and found evidence that illegal monetary gains and psychic rewards affect offender decision-making.

enhancements (Carson 2014; Enders and Sandler 1993; Pridemore and Freilich 2007). Such evaluations have yielded mixed findings, as some show promise, others are null, and a third set finds evidence of backlash implying that certain counterterrorism efforts may have created more violence (Fisher and Becker 2019; Dugan and Chenoweth 2012; LaFree et al. 2009).

While other research has generated more promising findings (Dugan et al. 2005; Grue-newald et al. 2015; Perry et al. 2016), the general implication that terrorists are not easily deterred has motivated scholars to look beyond traditional sanction-based measures. Recent scholarship considers the nuanced role of benefits in terrorist decision-making, as perpetrating such high-risk acts typically results in little personal gain and instead can contribute to a perceived “greater good” for their constituency. As noted by Clarke and Newman (2006:20) “the rewards of terrorism are less material and consist of obtaining satisfaction from ‘serving God’s will,’ humbling, taking vengeance on or destroying the enemy, and gaining prestige in the organization and in the supporting community.” Although other scholars have cited personal benefits like feelings of significance, fame, or honor (Hamm 2004; Kruglanski et al. 2009; Perry and Hasisi 2015), social rewards such as status in the community, or those associated with religion like the acquisition of an afterlife (Perry and Hasisi 2015), shifts toward and away from the idealized “greater good” may also play an important role in helping define the movement’s benefits level. In other words, as conditions worsen and the greater good appears to move further away, the urgency to act can intensify (i.e., raising the benefits of perpetration). Conversely, when conditions shift toward the greater good, that urgency dissipates, and it may be more difficult to motivate radical action.

Another related line of inquiry has conceptualized benefits as those government actions that reward prosocial rather than terrorist behavior. While benefits obtained from committing terrorism “pushes” people toward offending, rewarding people for abstaining can “pull” them away from perpetration. In assessing this conceptualization, Dugan and Chenoweth (2012) collected data on actions by the Israeli government that supported the well-being of Palestinian terrorists or their constituency, along with more traditional deterrence mechanisms of sanction severity and certainty. They also explicitly delineated the actions by whether they affected bystanders (indiscriminate) or only those suspected of terrorism (discriminate). The authors found that indiscriminate-conciliatory actions by the Israeli government were the most successful at decreasing Palestinian terrorism, especially during the Second Intifada. Interestingly, discriminate-conciliatory counter efforts, like releasing incarcerated Palestinians, were less successful. However, repressive government actions were discovered to be the most problematic, as some indiscriminate actions led to more violence. The authors acknowledged the ongoing need to punish terrorists, but also concluded that future counterterrorism efforts should also “consider the value of raising the expected utility of good behavior” (p. 619).

As the motives of the U.S. radical eco-movement differ substantially from other terrorist organizations, the specific components of the more comprehensive RCT likely also differ. The next section briefly describes the movement in order to better shape the hypotheses used in this research.

The Radical Eco-Movement in the U.S.

Environmental and animal rights extremists form one of the most active movements in the timeline of U.S. domestic terrorism (Carson et al. 2012). However, most of this movement’s activity takes the form of ideological-motivated crime rather than terrorism, with a nearly exclusive focus on property destruction. In fact, the use of violence has been rare,

with only one suspected lethality and a handful of injuries in a 37-year time span. Instead, and as Carson et al. (2012) demonstrated, almost 70% of incidents perpetrated by the movement involved some sort of damage, averaging nearly \$800,000 in losses. This enhanced ability to wreak economic havoc is likely what prompted law enforcement to at one time deem the eco-movement a significant terrorist threat to the U.S. (Freilich et al. 2009).

Interestingly, while the radical eco-movement's activity peaked in 2001, it has since dissipated considerably (Miller 2017). This decrease could be due to punitive government actions that directly targeted the movement. Indeed, environmental and animal rights extremists represent what can be considered a uniquely rational and “deterable” demographic. Those that subscribe to this ideology tend to be older (average age of 28) and are more often female, college educated, and in committed relationships (Chermak and Grunewald 2015; Liddick 2006). Furthermore, activists tend to consider the costs and benefits of engaging in illegal behavior, are especially sensitive to the long-term impact of punitive sanctions on their personal life, and appreciate the achievable gains from legitimate actions (Carson et al. 2012).

Nonetheless, the empirical literature that has specifically assessed the impact of punitive or repressive actions on eco-activity has been mixed. For example, Deshpande and Ernst (2012) conducted a case study of Operation Backfire, a targeted police crackdown, and concluded that this effort may have caused the Family—a cell of Animal Liberation Front (ALF) and Environmental Liberation Front (ELF) members—to disband. They note that, “as an investigation into the group’s actions and a potential deterrent, the effectiveness of Backfire cannot be overlooked” (p. 29). Yang and Jen (2017) reinforced this conclusion by finding that the Family did not displace their activities to other geographic locations after Operation Backfire. Other research has also concluded that legislative efforts were effective deterrents (e.g., Animal Enterprise Terrorism Act of 2006 (AETA) and the PATRIOT Act; Carson 2014; Yang et al. 2014). However, most government actions have been found to produce incident displacement or even backlash effects (Carson 2014; Yang et al. 2014), suggesting that the eco-terrorist movement also has a certain level of immunity to traditional deterrence.

To date, no known study has examined the possible impact of changes in the benefits of either perpetration or abstention in the decline of the radical eco-movement. As with other ideologically-motivated movements, such benefits would be delineated according to broader goals. For environmental and animal rights extremists, goals are typically couched in deep ecology and biocentrism philosophies, developed from the ideas of Arne Naess and based on the central tenant that all life is of equal value (Carson et al. 2012). Thus, this movement fights for the well-being of the environment and animals, rather than a specific population of people.

Interestingly, the radical eco-movement differs from other entities as they often go out of their way to avoid harming humans (Carson and Bartholomew 2016; Carson et al. 2019). For example, Carson and Bartholomew (2016) demonstrated that the accidental near decapitation of a logger from a tree-spike decreased subsequent terrorist attacks committed by the movement. The authors contend that this event shifted the collective eco-actors’ expected utility, where more was thought to be gained from distancing one’s self from the radical fringe—possibly reorienting the movement so that activists now reconsider the benefits of abstaining from potentially harmful acts. In fact, after that near decapitation, one activist, Judi Bari, partnered directly with loggers and admitted to “backing off” from the more radical fringe. Carson et al. (2012) found a similar sentiment expressed by the activists they interviewed, as many engaged exclusively in legal acts of protest out of concern over possible repercussions that an act of terrorism could have on the overall movement.

All in all, this line of research suggests that members of the radical eco-movement do consider costs and benefits when they make decisions. Furthermore, they might even consider the rewards of abstaining from illegal forms of activism before deciding whether to act. However, it is unknown whether such rewards, particularly those implemented by the federal government, were a factor in the radical eco-movement's decline. The next section outlines how we examine this possibility by mapping specific hypotheses to Becker's (1968) expected utility equation of RCT for the U.S. radical eco-movement.

Current Study

The previous sections noted important gaps in the extant literature. First, studies that apply RCT have largely failed to account for the benefits-side of the risk-reward calculation. Second and relatedly, counterterrorism research has also focused more on how punishment or the threat of punishment affects terrorist outcomes rather than exploring what happens when abstention is rewarded. In fact, virtually nothing is known about how changes in the benefits of perpetration or abstention influence the behavior of the radical eco-movement—one of the most active and uniquely rational movements in the United States.

Hypotheses

Informed by a rational choice framework, we present the following equation based on Becker's (1968) original formulation and inspired by Loughran and colleagues' recent contribution. Note, however, that we operationalize this equation at the movement level, under the assumption that individual decision-makers consider both their own well-being and the broader goals of the movement (see Dugan and Chenoweth 2012 for a similar strategy).

$$E(u_{\text{ecoincident}}) = p \times U(y - F) + (1 - p) \times U(y) \quad (1)$$

Here p represents the perceived probability of punishment, which is aligned with classic deterrence. While this may be considered an individual attribute, we argue that the overall perceived probability of punishment increases every time a specific eco-actor is publicly punished for their crime by the federal government.² Thus, we hypothesize the following:

H1 As the probability of punishment increases, eco-incidents will decrease.

We operationalize p with two measures: (1) the total number of highly publicized punishment acts of eco-radicals by national actors (e.g., F.B.I. operations and U.S. legal cases) and (2) the frequency of discrete acts against specific eco-actors (e.g., arrests). We characterize these measures as contributing to the probability of punishment (rather than the severity of punishment) because they demonstrate that offenders are being punished (rather than how harshly they are being punished). These two measures are distinctly operationalized as the former captures the intensity with which perpetrators are being pursued and the

² While we would ideally include punishment by both state and federal governments, resource limits preclude us from collecting data on all state-level arrests and prosecutions. However, we also argue that federal level activity is more salient to the movement as it signals precedent. In addition, this type of deterrence is less vulnerable to displacement to another jurisdiction.

likelihood of adverse consequences each time the federal government saliently punishes an eco-offender. The latter encompasses more of the day-to-day hostile messaging sent to specific members of eco-community through less permanent acts (e.g., disrupting protests) and rhetoric (e.g., criticizing activists and their behavior) by members of the federal government reinforcing the message that those who break the law will not be tolerated. These distinctions are detailed below.

H1a As the cumulative number of U.S. material acts of punishment increases, the frequency of eco-incidents will decrease.

H1b As the frequency of discrete acts against specific eco-actors increases, the frequency of eco-incidents will decrease.

In Eq. (1), y represents the anticipated benefits of an eco-act, which we frame as the distance between the current level of environmental protection and to where the movement aspires. As the intent of perpetrating eco-incidents is to coerce the government (and businesses) to better protect the environment and animals, when the current level of environmental protection is far from the ideal, the marginal benefit of perpetration is high. When the need for environmental protection is great, the movement has more to gain by wreaking havoc through illegal activity in order to draw awareness to the damages that are currently being imposed on the planet. Further, as the U.S. government passes laws to protect the environment, reducing the distance between the actual and ideal level of environmental protection, the marginal benefit of perpetrating another incident should decrease. As this marginal benefit (y) shrinks, so too does the expected utility, making an illegal act less appealing to the radical eco-movement. Consequently, we posit:

H2 As the marginal benefit of eco-incidents decreases, eco-incidents will decrease.

With all of this in mind, we operationalize y as: (1) the total number of laws in place that protect the environment, and (2) the frequency of both pro- and anti-environmental day-to-day activities by the U.S. federal government in order to capture the different types of marginal benefits. As with punishments, the accumulation of laws represents the current level of environmental protection. The second two measures capture more ephemeral variation in environmental safeguards and damage expressed by members of the federal government, such as advocating for pro-environmental or pro-energy industry policy. Thus, our secondary hypotheses become:

H2a As the cumulative number of laws that protect the environment increase, the frequency of eco-incidents will decrease.

H2b As the day-to-day government actions that could protect the environment increase, the frequency of eco-incidents will decrease.

H2c As the day-to-day government actions that could harm the environment decrease, the frequency of eco-incidents will increase.

Finally, F in Eq. (1) represents the severity of punishment, which relates to the punitive level of sanctions administered to those who break the law in protest of environmental

and animal rights. We expect that as the government passes laws that increase the level of punishment of perpetrating acts of eco-related illegal activity, the severity of punishment increases, thus reducing the number of eco-incidents. We hypothesize:

H3 As the severity of punishment increases, the frequency of eco-incidents will decrease.

Here, the severity of punishment is measured by the cumulative number of laws that increase sanctions against eco-penetrators. This measure most aligns with the punishment climate, as it depicts the number of laws passed to date that enhance punishment for convicted eco-perpetrators.

H3a As the cumulative number of laws that increase sanctions against eco-penetrators are passed, eco-incidents will decrease.

Finally, we draw upon Dugan and Chenoweth's (2012) extension of RCT to consider the effects of rewards for abstention. In Eq. (2), q represents the probability of receiving rewards from abstaining from eco-incidents; x represents the status quo; and G represents the anticipatory rewards from abstaining.

$$E(u_{\text{abstention}}) = q \times U(x + G) + (1 - q) \times U(x) \quad (2)$$

Our final hypothesis focuses on G , and argues that when those rewards increase, eco-incidents will decrease.

H4 As the rewards of abstention increase, the frequency of eco-incidents will decrease.

We operationalize these rewards by the number of actions by the U.S. federal government that support the well-being of specific members of the radical eco-movement. This measure encompasses the day-to-day accolades by federal actors directed toward specific eco-activists, with the expectation that they would encourage others to adhere to strictly legal forms of activism.

H4a As the number of U.S. federal government actions that support specific members of the eco-movement increases, eco-incidents will decrease.

Data

Data for this research were obtained from three primary sources. The dependent variable is constructed from the Eco-Incidents Database (EID), while the primary independent variables originate from a subset of the Government Actions in Terror Environments-USA (GATE-USA) data coupled with a legislative search by the authors.

Eco-Incidents Database

The dependent variable was constructed from the EID [GTD; see Carson et al. (2012) for a full review]. The data originator led a team that scoured multiple sources to acquire the original 1068 illegal incidents *committed in the name of the environment, animal rights, or both*

that occurred in the United States from 1970 to 2007. These sources included chronologies collected by the Foundation for Biomedical Research,³ the National Alliance for Animals, the Fur Commission, the Department of Homeland Security, the Southern Poverty Law Center, the Seattle Post-Intelligencer, the Anti-Defamation League, the Department of Justice, and the Department of Agriculture. Given the potential biases of these entities, coders double checked all incidents against open sources. The strength of the EID is that includes ideologically-motivated crime in addition to terrorism, which is especially imperative to studying this movement given that crime considerably outweighs terrorism. In addition, the EID includes incidents that were accomplished independently of any organized group, which is significant as the movement most often follows a leaderless resistance model.⁴

The EID was recently extended to include terrorist attacks from 2008 to 2012 by using the same procedures to extract terrorism incidents from the GTD that were used in the original EID—namely, a group-based collection effort followed by a keyword search. Given the frequent updating of earlier GTD events, we also compared the most recent GTD to the pre-2012 cases to add any additional incidents. Unfortunately, we were unable to include eco-criminal events after 2008 because the Foundation for Biomedical Research—the primary source of the EID—no longer releases their data to the public.

As there were no verified terrorist attacks committed by the movement in 2012, we limit analysis to 1989 through 2011 (i.e., the GATE data dictated the 1989–2012 range). The total number of eco-incidents are then summed to the monthly level to form the dependent variable for analyses.

Government Actions in Terror Environments (GATE)-USA Data

The day-to-day government actions used to create the frequency counts needed to test hypotheses H1b, H2b, H2c, and H4a were extracted from a subset of the GATE-USA data, which document all actions by the federal U.S. government that are relevant to terrorist organizations or their constituencies that pose a threat to civilians at home or overseas (see Chenoweth and Dugan 2016). The original source of GATE-USA data collection is all Reuters news articles that mention key federal U.S. government actors between 1989 and 2012 [totaling nearly 2 million articles; see Chenoweth and Dugan (2016) for the complete list of search terms]. Lead sentences were extracted from the articles and coded using Textual Analysis by Augmented Replacement Instructions (TABARI), which searches and identifies stories that match the criteria of an extensive set of dictionaries designed to capture political activity (Schrodt 2012). Dictionaries were supplemented with perpetrator names obtained from the GTD (START 2016), the Southern Poverty Law Center, the United States Extremist Crime Database (ECDB; Freilich et al. 2014), and the American Terrorist Study (ATS; Smith et al. 2001). Final cases were coded by research assistants and cleaned by the investigators.

For the current project, we kept only actions by U.S. federal actors related to the environment, animal protections, eco-activists, or eco-radicals between January 1989 and November 2011. This resulted in 513 environmentally relevant actions, which were then coded as discrete punitive (12; H1b; e.g., environmental activists were arrested for chaining

³ Although this entity had a focus on animal enterprise attacks, its chronology did include attacks against environmental targets as well.

⁴ For example, Walter Edmund Bond was solely responsible for a series of arsons but had the Animal Liberation Front's (ALF) "press office" release a statement saying they were committed in the name of ALF.

themselves to EPA building entrance), protection for the environment (311; H2b; e.g., President Obama said it was fair to ask whether BP had an incentive to be forthcoming about the extent of damage cause by the spill); harmful to the environment (179; H2c; e.g., President Bush says he plans no new action to impose greenhouse emission caps), or rewards for abstention (11; H4a; e.g., the Supreme Court announces that it will decide whether an officer who used excessive force when arresting an animal rights activist will be denied immunity). As evident from these examples, the strength of the GATE-USA data is that it includes all actions regardless of their magnitude, thus capturing the amount of attention given toward environmental issues on a day-to-day basis.

Data are aggregated to monthly counts of actions that are discrete-punitive, protection for the environment, harmful to the environment, and rewards for abstention. Actions are then lagged in order to allow time for the movement to react (Smith et al. 2017).

Legislative Data

In addition to the government actions identified by GATE-USA, we also conducted a thorough search to identify eligible operations, legal cases, and laws since 1948 in order to capture the climate of punishment (H1a), marginal benefit of perpetration (H2a), and the severity of punishment (H3a). We found six major operations and case decisions that we categorized as U.S. material acts of punishment (H1a). These include *United States v. John P. Blount* on September 6, 1994, the arrest of SHAC-7 on May 26, 2004, *United States v. Joel Andrew Wyatt* on May 26, 2005, Operation Backfire on December 1, 2005, *United States v. Stop Huntingdon Animal Cruelty, Inc.* on October 14, 2009, and *United States v. William James Viehl* on January 11, 2010. We also classified 120 Acts related to protecting the environment and animals (H2a). Examples of these include the Animal Welfare Act of 1955, the National Fish and Wildlife Foundation Establishment Act of 1992, the Oil Pollution Act of 1996, and the Water Pollution Control Act of 2003. Finally, six laws are classified as enhancing sanctions against eco-perpetrators (H3a): The Anti-Drug Abuse Act (ADA) of November 18, 1988 (tree-spiking clause), The Animal Enterprise Protection Act (AEPA) of August 26, 1992, the Recreational Hunting Safety and Preservation Act of 1994, which passed on November 13, 1994, the Anti-Terrorism and Effective Death Penalty Act (AEDPA) of April 24, 1996, the PATRIOT Act of October 26, 2001, and The Animal Enterprise Terrorism Act (AETA) of November 27, 2006. As mentioned above, all three types of legal actions were measured cumulatively for each month to capture that month's level of probability of punishment, marginal benefit of perpetration, and punishment severity. These differ from the government actions measured in GATE, as each depicts a change in precedent or lasting change in the legal environment rather than the day-to-day gestures or statements made by the current members of the federal government.

Analytical Methods

All data are configured as monthly times-series data, with the cumulative legislative acts, laws, and operations measured during the current month. The unit-root test results⁵ show that all trends except the cumulative laws are stationary. In order to detect seasonal effects,

⁵ We did not include the unit-root tests in the paper to save space. The test results are available upon request.

we conduct separate sensitivity analyses to identify the most appropriate time interval for the analyses. Various criteria, such as AIC and HQ tests, are used to help select the optimal number of lags in the analysis. The results suggest that we should have a maximum lag length of 4 for each variable. Hence, all the subsequent analyses are conducted with 4 lags included to capture any delayed or persistent effects.

In order to examine the interrelationship between the government's environmentally-relevant actions and our dependent variable, we employ two statistical approaches—Granger causality tests and autoregressive Poisson regressions. Granger causality tests are used to examine the short-term causality between the time trends among variables and to identify any reciprocal relationships. Thus, the results from Granger causality tests serve as a foundation to examine whether the hypothesized relationships exist between the core variables (at the monthly level). We run both the Block Granger Causality tests and the pairwise Granger tests using the core variables. Block exogeneity tests help to examine the effects of all government activities on eco-incidents and the pairwise tests focus more on the short-term reciprocal relationships between the variables. To better delineate the directionality of the effects and the optimal time interval for estimating the influence between trends, we estimate the effects for each lag in the pairwise models. The autoregressive Poisson regressions provide a more precise test of the specific hypotheses by incorporating additional control variables. Together, the analyses triangulate the findings and serve as robustness tests for one another.

Granger Causality Test

The Granger causality test is a method commonly used in economics to test causal relationships in time series data (Sims 1972; Rogers et al. 1996; Granger et al. 2000). In recent decades, criminologists have begun to acknowledge its usefulness when estimating effects using time series data (for example, see Marvell and Moody 1997, 1999; Moody and Marvell 1996; Yang 2007).

Generally, the Granger causality test uses available temporal information between a set of variables to assess which variables induce subsequent changes in the others (Rogers et al. 1996; Granger et al. 2000). The operational definition of Granger causality is two-fold. First, the cause must occur before the effect; and second, the cause must uniquely contain information about the effect (i.e., contained in no other variable; Granger 2004). These analyses test whether two (or more) trends are causally related within the specified time interval. In sum, to be considered “Granger causal,” trend X at time t needs to contain information that helps forecast trend Y at time $t + 1$.⁶

The operationalization behind Granger causality is quite simple: If variable X Granger causes Y , then two conditions must be met. First, X should help predict Y ; the past observation of X (lagged values of X) should also help predict Y in a regression sense (Sims 1972, p. 541). Second, Y should not help predict X .

⁶ In the economic literature, when using the Granger causality test, people tend to use the term “Granger causes” when describing causal associations. However, this is not the norm in criminology. Thus, we mostly use “cause” instead of “Granger cause” in this manuscript to avoid awkward language.

In order to test whether government actions cause eco-attacks, we construct two sets of scenarios expressed in Eqs. (3) and (4) below (Y_t represents the eco-incidents and X_t represents government actions).⁷

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^4 \alpha_{1i} \Delta Y_{t-i} + \sum_{i=1}^4 \alpha_{2i} \Delta X_{t-i} + \varepsilon_{Yt} \quad (3)$$

$$\Delta X_t = \beta_0 + \sum_{i=1}^4 \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^4 \beta_{2i} \Delta X_{t-i} + \varepsilon_{Xt} \quad (4)$$

The research hypotheses of the current study (H1–H4) are built to evaluate whether various forms of government actions lead to eco-incidents. From these tests, we can conclude Granger causality of government actions on eco-incidents if we find a significant relationship and reject the null. Further, failing to reject the null implies that government actions do not lead to more eco-incidents. However, we also examine the possibility of the reverse effects on whether government's actions were just reacting to previous eco-attacks. Likewise, failing to reject the null in the reverse direction suggests that eco-incidents do not result in government's actions. If neither can be rejected, then the government actions and eco-incidents are independent series. The reciprocal effects are tested in the pairwise analyses. The rejection of both null hypotheses suggests a “feedback” loop between government actions and eco-incidents where an instantaneous causality exists between the variables. As mentioned earlier, four time lags are included in all the Granger models to assess the effects of the past observations of one trend on the current value of the other trend.

Because Granger Causality tests are used to examine the causal relationships among a set of variables, we first examined the effects of our independent variables on eco-incidents by running the Block Granger Models. We follow the Toda-Yamamoto approach (Toda and Yamamoto 1995; Awokuse 2003) and test for the absence of Granger causality using the Vector Autoregressive (VAR) exogeneity tests. The null hypothesis of the test is the absence of Granger causality. Thus, a *rejection* of the null implies there exists Granger causality between the variables of interest. We then run the pairwise tests to further scrutinize the interrelationship between trends by examining the two-way causality.⁸

⁷ There is one important point that needs clarification regarding the Granger causality test. Enders (2004) points out that Granger causality is somewhat different from a test of exogeneity (Enders 2004). An exogeneity between two variables requires a temporal order and causal connections between the occurrences of the two. Granger causality examines whether the use of current and past values (or changes) of one variable help predict future values (or changes) of another variable. Therefore, the Granger causality test satisfies the temporal order requirement of an exogeneity test. Without the inclusion of all possible independent variables in the model, however, the Granger causality test cannot be used to identify the true causes of a variable. In addition, a contemporaneous effect between two variables would also be considered as causal under the Granger causality framework. This type of relationship is usually referred to as “Granger Causation” to be distinguished from “true causation”.

⁸ Per the suggestion of the reviewers, we tested the effects of each time lag to see if the differential effects due to different time length could possibly cancel out each other and render the overall findings insignificant.

Autoregressive Poisson Regressions

Given that the dependent variable is the monthly count of all eco-incidents and that it is likely to be serially correlated, we use autoregressive Poisson Regressions (APRs) to estimate the effects on this relatively rare event. We first run ARIMA models on the dependent variable, despite its nonnormality, to estimate the nature of its error dependency. This gives us a starting point for the autoregressive parameter in the APR model.

Equation (5) presents the specification of the APR. This equation demonstrates an important difference between the Granger causality test and method used here. The Granger models shown in Eqs. (3) and (4) exclude all control variables. The APR model presented in Eq. (5) encompasses variables for all hypotheses, as well as controls, in a single model. Therefore, we anticipate that these findings will unlikely mimic those for the Granger models exactly. However, we do anticipate that if our hypotheses are correct the findings will tell a similar story. In Eq. (5), *EcoInc* represents the dependent variable, eco-incidents, which is measured at time t . We model the dependent variable using the specific constructs delineated above that represent the perceived probability of punishment (H1) with *PC* measuring the cumulative number of punishing laws and federal operations against eco-radicals and *PF* as the frequency of discrete punishing acts against eco-radicals; the marginal benefits of perpetration (H2) with *YC* representing the cumulative laws protecting the environment and *YF* measuring the frequency of specific acts to protect or harm the environment (operationalized separately); the severity of sanctions (H3) with *FC* as the cumulative number of laws that enhance sanctions; and the benefits of abstention (H4) with *GF* as the number of U.S. actions that reward abstention. Note that *PF*, *YF*, and *GF* allow for $t-1$ through $t-k$ lags. We initially allow for up to 4 lags and when lagged measures are null, we drop them for model parsimony. We also include as controls a dummy variable for the post 2008 EID data (*EID2*), dummy variables for each president (*Presid*), a monthly count to control for any increasing or decreasing trend in incidents (*Count*), and dummy variables for each month to absorb any related seasonality (*Month*). The monthly count variable is especially important given that the cumulative operations, laws, and acts all follow a positive trend.

$$EcoInc_t = f(PC_t, PF_{t-1...t-k}, YC_t, YF_{t-1...t-k}, FC_t, GF_{t-1...t-k}, EID2_t, Presid_t, Count_t, Month_t) \quad (5)$$

All tests are two-tailed to capture unanticipated effects.

In sum, we use the Wald F -statistics in Granger causality tests to examine the short-term causality among government's actions/laws and eco-incidents using the joint F test; the autoregressive Poisson regressions to estimate the magnitudes and the directions of the effects (Türsoy 2017).

Results

Descriptive Analysis

We calculated the dependent variable from the 965 total incidents perpetrated by the radical eco-movement from 1989 to 2011. Of these, 189 fit the aforementioned LaFree and Dugan's (2007) definition of terrorism, while 776 were classified as crime. Figure 1 shows that the number of total incidents increased from 1992, reached a first peak of forty incidents in 1997, and then declined gradually. Starting from 1998 the number of incidents

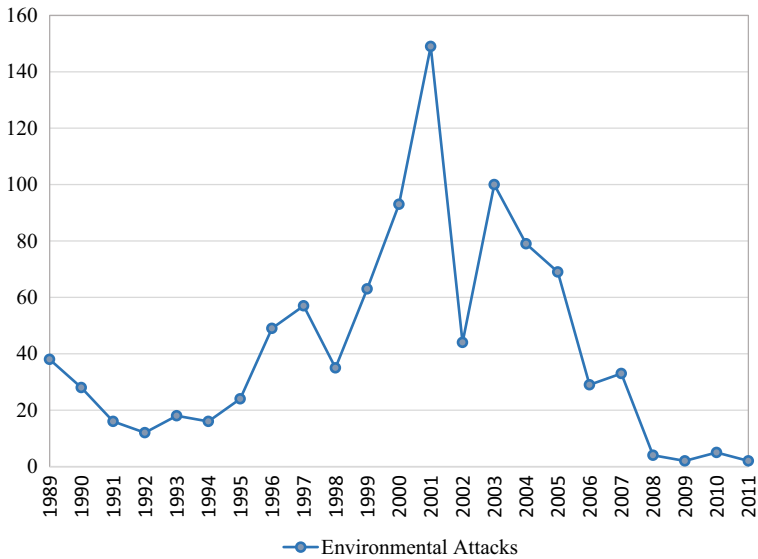


Fig. 1 Trends of environmental events from 1988 to 2011

rose rapidly and maxed out in 2001, followed by a sharp decline in 2002 before picking up again in 2003 with roughly 100 events. After 2003, the number of incidents continued to decline. The developmental patterns are similar for the terrorist only incidents, although it is substantially lower. Note that after 2008 the EID data only include terrorist events, explaining the drop in total incidents after that year.

The summary statistics for all variables in the models are shown in Table 1. Beginning with the outcome variable, we see that on average each month experienced 3.47 eco-incidents per month. Figure 1 shows much variation across the series, as activity in each peaked prior to 2001. In fact, we see from Table 1 last column that about a quarter of the months experienced no eco-activity.

When we examine the key independent variables in Table 1, we first turn to the variables marked with the asterisk as they are measured as frequencies of government actions from the GATE-USA data. The most common of these are acts, gestures, or statements by the U.S. government are those in favor of protecting the environment (H2). On average, the federal government acted to benefit the environment 1.15 times a month compared to acting against the environment 0.66 times a month (H2). In contrast, the government rarely acts discriminately against or in favor of specific eco-perpetrators as 96% and 98% of the months showed no punishing acts (H1) or efforts rewarding abstinence (H4), respectively.

The key independent variables without asterisks present the cumulative laws and operations, and the min and max present the values at the beginning and end of the series. Unsurprisingly, most laws passed by the U.S. government protected the environment (H2) as 68 were on the books at the beginning of the series, and 120 at the end, which is a growth of nearly 100%. The punitive laws and operations (H1) and laws enhancing sentences (H4) each only totaled 6 by the end of the series. However, when we compare their means, it is clear that the sanctioning laws were passed earlier in the series as more months have higher values

Table 1 Descriptive statistics of variables in the models

Variable	Mean	SD	Min	Max	P(0)
Eco-incident	3.46	4.25	0	26	0.24
<i>Hypothesis 1</i>					
Punitive laws & operations	1.86	1.89	0	6	0.24
Punishing acts*	0.04	0.21	0	1	0.96
<i>Hypothesis 2</i>					
Laws protecting environment	97.50	17.57	68	120	0.00
Acts protecting environment*	1.15	1.60	0	10	0.45
Acts harming environment*	0.66	1.28	0	9	0.65
<i>Hypothesis 3</i>					
Laws enhancing sanctions	4.00	1.70	1	6	0.00
<i>Hypothesis 4</i>					
Acts rewarding abstention*	0.04	0.23	0	2	0.98

*These acts are lagged by one month for this table

(mean = 4.0 versus 1.86). Of course, this makes sense as the actual case laws and F.B.I. operations used the earlier laws to enforce their actions.

Granger Causality Findings

We now turn to the Granger causality tests for hypotheses 1 thru 4. We first use the VAR Block Granger models to evaluate the effects of government actions, legislative acts, operations as a whole system and their Granger causalities with eco-incidents.⁹ The results in Table 2 are ordered by the hypotheses. The values shown in Table 2 reflect the changes in model fit when each variable was excluded, one at a time, to reveal its relative impact on the outcome measures. By doing so, we can estimate the joint associations of the government-related activities on illegal behavior of the radical environmentalists and animal right activists.

When the government acts in a timely and targeted manner, it tends to have more impact on eco activities. We find strong support that enhancing the probability of punishment impacts eco-incidents. This is evidenced by the significance of punitive laws, operations (H1a), but not for punishing acts (H1b). We also find that acts harming the environment (H2c) and those that reward abstention (H4a) demonstrate significant Granger causalities on eco-incidents. However, we are unable to find impacts of the cumulative laws or acts that were intended to protect environment on eco incidents (H2a & H2b). Moreover, the effects of laws that seek to enhance the severity of punishment are also null (H3a).

Overall, the findings provide preliminary support for Hypotheses H1a, H2c, and H4a; most of which focus on the effects of the day-to-day government actions on eco-incidents. Specifically, the results suggest that environmental groups do consider the probability of punishment, the marginal benefits of their activities, and the reward of abstention between 1989 and 2012.

⁹ We appreciate the reviewer's suggestion of adding the VAR block Granger analysis tests to the paper. The null hypothesis of this test is Granger non-causality. That is, a significant finding indicates the existence of Granger Causality running from one variable to the outcome variable in the model.

Table 2 VAR block Granger causality tests of the relationships between government laws/actions and eco-incidents

	All eco-incidents Chi Square (Prob.)
<i>Hypothesis 1: Probability of punishment</i>	
H1a: Punitive laws & operations	11.955** (0.018)
H1b: Punishing acts	6.415 (0.170)
<i>Hypothesis 2: Marginal benefits</i>	
H2a: Laws protecting environment	4.104 (0.392)
H2b: Acts protecting environment	2.764 (0.598)
H2c: Acts harming environment	12.840** (0.012)
<i>Hypothesis 3: Severity of punishment</i>	
H3a: Laws enhancing sanctions	2.383 (0.666)
<i>Hypothesis 4: Rewards for abstention</i>	
H4a: Acts rewarding abstention	20.259*** (<0.001)

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; Lags = 4

While the Block Granger Models provide us an overview of the effects among government actions, legislative acts, and operations on eco-incidents, the results from pairwise Granger tests reveal the interrelationships and the directionality of the short-term causality (if any) between the trends. In order to get a better sense on the proper time interval of impacts, we evaluate the effects of each time lag on the outcome variables in the pairwise Granger analysis.

Tables 3 presents the overall results of the pairwise Granger causality tests, which provide us with a more nuanced picture on the interrelationship among government's activities and eco-incidents. The second column in the table shows the value of the significant lagged estimate and the direction of the estimate (e.g., $-2(+)$ indicates that the second lag was positive and significant). Table 3 presents these findings and shows significant support for punishing acts on reducing subsequent eco-incidents 4 months later (H1b). Government's acts that harm the environment lead to more eco-attacks within just a month (H2c). At the same time, the increase in eco-incidents yields an escalation in punitive laws, increasing the severity and probability of sanctions few months after the events (but the overall effect is not significant (H1a; H3a)). Finally, the relationship between government acts that rewarding abstention and eco-incidents is complex. The relationship connecting the two entities suggests that while eco-incidents tend to decline when the government rewards abstention in lag 3(H4a), it increases in lag 4. Given that rewards for abstention are relatively rare and that these signs flip, we interpret this effect with caution.

Autoregressive Poisson Findings

ARIMA tests found that the dependent variable best fit an AR(3) process. Further, when assessing the later autocorrelations, we discovered that we needed to add a parameter for the 20th lagged observation. Therefore, we included parameters for the first three observations in both ARP models, and additionally for the 20th.

The coefficients and the marginal effects in the change in rate ($\exp(\text{coef})$) of eco-incidents estimated by the APR models are presented in Table 4. Overall, we find some support for hypotheses 1, 2, and 4, suggesting that the probability of punishment (via punitive laws

Table 3 Pairwise Granger causality tests of the relationships between government laws/actions and eco-incidents

	– Sig. Lags (direction of the effect)	Wald statistics	Prob.
<i>Hypothesis 1: Probability of punishment</i>			
H1a: Punitive laws & operations \Leftrightarrow eco-incidents			
Punitive laws & operations \Rightarrow eco-incidents	0	1.420	0.228
Punitive laws & operations \Leftarrow eco-incidents	–2(+)	1.668	0.158
H1b: Punishing acts \Leftrightarrow eco-incidents			
Punishing acts \Rightarrow eco-incidents	–4(–)	3.607***	0.007
Punishing acts \Leftarrow eco-incidents	0	2.976**	0.020
<i>Hypothesis 2: Marginal benefits</i>			
H2a: Laws protecting environment \Leftrightarrow eco-incidents			
Laws protecting environment \Rightarrow eco-incidents	0	0.487	0.745
Laws protecting environment \Leftarrow eco-incidents	0	0.472	0.756
H2b: Acts protecting environment \Leftrightarrow eco-incidents			
Acts protecting environment \Rightarrow eco-incidents	0	0.606	0.659
Acts protecting environment \Leftarrow eco-incidents	0	1.150	0.334
H2c: Acts harming environment \Leftrightarrow eco-incidents			
Acts harming environment \Rightarrow eco-incidents	–1(+)	5.107***	< 0.001
Acts harming environment \Leftarrow eco-incidents	0	1.930	0.106
<i>Hypothesis 3: Severity of punishment</i>			
H3a: Laws enhancing sanctions \Leftrightarrow eco-incidents			
Laws enhancing sanctions \Rightarrow eco-incidents	0	0.153	0.962
Laws enhancing sanctions \Leftarrow eco-incidents	–4(+)	1.712	0.148
<i>Hypothesis 4: Rewards for abstention</i>			
H4a: Acts rewarding abstention \Leftrightarrow eco-incidents			
Acts rewarding abstention \Rightarrow eco-incidents	–3(–), –4(+)	3.832***	0.005
Acts rewarding abstention \Leftarrow eco-incidents	0	1.004	0.406

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

and operations), changes in the marginal benefit of committing the act (via acts against the environment), and acts that reward abstention relate as expected to affect the number of eco-incidents—although the latter effect is delayed. The results show no support for hypotheses 3. When we compare the magnitudes of effects across types, as U.S. officials prosecuted eco-offenders or committed highly visible operations against them, the rate of offending declined by 0.382.¹⁰ The magnitude of the effect of one more act that harms the environment increases this rate by 0.189. We see that the effects of acts rewarding abstention is only detected 3 months after an increase in eco-incidents. Here we find that the rate of eco-events declines by 0.461.

¹⁰ These marginal effects were calculated by exponentiating the estimated coefficients. As this shows the change in the baseline rates, we subtracted the exponentiated value from one.

Table 4 Autoregressive Poisson coefficients and exponentiated coefficients

Variable	Coefficient estimate	Exp (coef.)
<i>Hypothesis 1</i>		
Punitive laws & operations	−0.481***	0.618
Punishing acts	−0.019	0.982
<i>Hypothesis 2</i>		
Laws protecting environment	0.035	1.036
Acts protecting environment	0.012	1.012
Acts harming environment	0.173***	1.189
<i>Hypothesis 3</i>		
Laws enhancing sanctions	0.025	1.025
<i>Hypothesis 4</i>		
Acts rewarding abstention	−0.062	0.940
−Lag 2	−0.036	0.964
−Lag 3	−0.619***	0.539
EID2	−2.658***	0.070
Bush Sr.	−0.179	2.008
Clinton	0.650	1.916
Bush Jr.	−0.179	0.836
Monthly Count	0.010	1.010
January	0.076	1.079
February	0.080	1.083
March	0.466*	1.593
May	0.136	1.146
June	0.093	1.098
July	0.237	1.268
August	0.243	1.275
September	0.293	1.341
October	0.073	1.076
November	0.527*	1.694
December	0.145	1.156

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. All tests are two-tailed

The findings for the control variables are as expected, as the number of events is lower after 2008 when only terrorism data were available. The controls also indicate that after holding all measured actions constant, eco-terrorist attacks were higher in March and November, relative to April.

As tests of robustness, we reran the models after excluding observations with especially large residuals. The substantive findings remained the same. We also reran the models using Prais–Winsten AR(1) estimates that corrected for heteroskedasticity. The substantive findings also remained the same.

Conclusions

This research, which applied all components of RCT to the behavior of the radical eco-movement in the United States from 1989 through 2011, found strong support for hypotheses 1 and 2, cautious support for hypothesis 4, and no support for hypothesis 3. Table 5 summarizes these findings, from both the Granger causality tests and the autoregressive Poisson regression. We anticipated that as the probability of punishment increases, eco-activity would decrease (H1). Both models revealed evidence consistent with this hypothesis, although the effective measure varied across models. The Block Granger and ARP models picked up on the effects of federal court cases and F.B.I. operations that prosecuted and arrested specific eco-radicals, and the Pairwise Granger tests found evidence of a mutual relationship between the punishing day-to-day acts by the U.S. government and eco-lawbreaking. Combined, these findings do suggest that eco-radicals are sensitive to deterrence efforts and will refrain from offending if the punitive environment suggests that they will be punished for their behavior.

All three models discovered support for hypothesis 2, which claimed that raising the marginal benefit of perpetration is associated with more incidents. When the government increasingly acts in ways that harm the environment, like introducing bills to relax environmental protections, this hypothesis is supported. This suggests that the radical eco-movement is sensitive to the day-to-day activities of the government, especially those efforts that may have negative implications for the environment. However, the effect of protective actions by the government is null in all analytical models, indicating that the eco-movement is unlikely to back off when members of the federal government advocate on behalf of the environment.

Consistent with the broader deterrence literature, none of our findings supported hypothesis 3 that lawbreaking will decline if the severity of punishment increases. The broader deterrence literature has repeatedly found that certainty, rather than severity, seems to keep individuals from offending, particularly in young adult populations (Pratt et al. 2006); a demographic similar to those within the eco-movement. Finally, we cautiously report that rewarding abstention is related to the unlawful behavior of the radical eco-movement. All models discovered a delayed response to efforts by the federal government to protect the civil liberties of specific members of the movement. However, the change of signs in the pairwise Granger model suggests that the findings are unstable. That said, the ARP findings indicated that pursuing efforts to uncover the effects of protecting the rights of activists on illegal activities is worth more effort.

Of course, this study suffers from limitations that should be improved upon in future research. Traditionally, RCT has been conceptualized as a micro-level theory that outlines the role of costs and benefits for individuals. By using a macro-level analysis, we rely upon the assumption that the behavior of the movement is an aggregate response of the many individuals who make up the movement. This follows the practice of others who have conducted aggregate tests of deterrence using interrupted time series after establishing that macro-level outcomes can be an aggregation of micro-level behaviors (see Nagin 1998). Further, these findings align with earlier interviews with environmental and animal rights activists that found them to be rational actors who consider the costs and benefits of their behavior.

We also recognize limitations in both our data and methodology. Both the GATE-USA and the EID rely on the validity of open sources to capture the universe of government actions and eco-incidents. Since the GATE data are obtained from only one

Table 5 Summary of significant hypothesis test results across models

Hypothesis	Block Granger causality	Pairwise Granger causality	APR (directional relationship)
H1: Probability of punishment+	Punitive laws & operations	Punishing acts	Punitive laws & operations
H2: Marginal benefit of perpetration+	Acts harming environment	Acts Harming Environment	Acts harming environment
H3: Severity of punishment–	Null	Null	Null
H4: Rewards of abstinence–	Acts rewarding abstinence	Acts rewarding abstinence	Acts rewarding abstinence

source, Reuters News, which is based in the United Kingdom and focuses on international news, it is more likely to miss low profile actions. However, and given that GATE only includes acts by the U.S. federal government and Reuters reports daily on actions of the U.S. government, most efforts are likely to be captured. The EID data also likely undercounts the number of eco-crimes, as not every illegal action committed by a radical eco-group will come to the attention of a chronology or newspaper. Tangentially, we were unable to collect data on local law enforcement's responses to eco-activity. While this is indeed a limitation, we point out that we were able to detect effects with the federal measures on the probability of punishment, suggesting that local efforts might also be successful.

In terms of analytical methods, and despite the sophisticated models used in the study, we are unable to establish a genuine “causal” relationship between government actions and eco-incidents. Without being able to rely upon a true experimental design to isolate “causes,” we take comfort in uncovering a better understanding of the temporal relationship by using three time-series analytical approaches. Despite this endogeneity problem, which is commonly seen in terrorism research, we believe our study provides a comprehensive examination of the activities of environmental and animal rights extremists based on a rational choice theory framework.

In sum, what the government does appears to matter. Our findings suggest that improvements to the environment do not appear to quell the radical eco-movement, but federal actions that put the environment at risk will likely fuel the movement. On the other hand, the illegal behavior of this movement appears sensitive to threats of arrest and prosecution—but not severe sanctioning, suggesting that high profile arrests and prosecutions of particularly troublesome eco-criminals might encourage others to stick to strictly legal acts of protest.

These findings have particularly strong implications in the current political climate. Leadership at the Environmental Protection Agency by self-described opponents of its existence, namely Scott Pruitt and the more recent addition of Andrew Wheeler, coupled with the resulting loosening of regulations, suggests the radical eco-movement might be ready and willing to break the law. Indeed, Pruitt's short tenure was marked by conflict both within and outside the agency, including threats to his person (Lipton and Vogel 2018). This perception of a less environmentally-friendly government, in addition to the newest iteration of the radical eco-movement as an anti-fascist entity (Anti-Fa), make the results of this investigation all the timelier. It is vital that the government counters from a vantage that takes into account the complexity of this movement and their behavior.

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