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Illegal drug production, specifically marijuana in California, and cocaine in South America, is resulting in intensive environmental degradation. While commonly cited as detrimental to societal health, the impacts of illicit drugs are rarely referred to as environmentally threatening. Ecosystem toxification, greenhouse gas emissions, and unsustainable water usage account for a variety of malign effects resulting from the plantation, harvest, and production of cannabis and cocaine. Ecosystem degradation remains a serious concern into the 21st century, a result indicative of the fact that current methods designed to stem the drug-trade too often involve reactionary enforcement measures by unitary actors. Preventive, not reactive, actions must be implemented to stop the production of illicit drugs in their initial stages, before ecosystem injury occurs. Coordinated efforts involving the integration of environmental and enforcement agencies, in intrastate *and* international realms, will be imperative for the establishment of a competent, global, anti-drug security system. Public sector involvement, through petitions and advertising campaigns by non-governmental organizations and environmental interest groups, can assist government efforts by raising awareness of drug-initiated ecosystem degradation and persuading constituents to lobby legislators for legal revisions.

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Environmental Impacts of Illicit Drug Production

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ABSTRACT

Illegal drug production, specifically marijuana in California, and cocaine in South America, is resulting in intensive environmental degradation. While commonly cited as detrimental to societal health, the impacts of illicit drugs are rarely referred to as environmentally threatening. Ecosystem toxification, greenhouse gas emissions, and unsustainable water usage account for a variety of malign effects resulting from the plantation, harvest, and production of cannabis and cocaine. Ecosystem degradation remains a serious concern into the 21st century, a result indicative of the fact that current methods designed to stem the drug-trade too often involve reactionary enforcement measures by unitary actors. Preventive, not reactive, actions must be implemented to stop the production of illicit drugs in their initial stages, before ecosystem injury occurs. Coordinated efforts involving the integration of environmental and enforcement agencies, in intrastate *and* international realms, will be imperative for the establishment of a competent, global, anti-drug security system. Public sector involvement, through petitions and advertising campaigns by non-governmental organizations and environmental interest groups, can assist government efforts by raising awareness of drug-initiated ecosystem degradation and persuading constituents to lobby legislators for legal revisions.

Keywords: Illegal Drugs; Drug Production; Ecosystem; Degradation; Deforestation; Cocaine; Marijuana

INTRODUCTION

The consumption of cocaine and marijuana has long been a concern of modern society. Starting with Richard Nixon's declaration of a "War on Drugs" in 1971, the United States has been fixated on the correlation between illicit drugs and crime rates, incarceration, and societal health. The impacts of illicit drugs however, have rarely been addressed in their relation to the environment. Revelations of the severe damages incurred on the environment as a consequence of cannabis and cocaine production will be necessary for the revision of bureaucratic frameworks and societal perspectives. Once the public has been properly informed of the issues at hand, they subsequently will be able to

appeal to their legislators for legal reform. Government agencies, both environmental and enforcement, must also contribute to anti-drug efforts by taking on the responsibility of incorporating their knowledge and resources with their counterparts, both domestic and international, in order to adequately address this global issue.

ENVIRONMENTAL ISSUES

Toxification

Toxification of the environment, resulting from the plantation, growth, and harvest of cocaine and cannabis occurs in a variety of methods. Toxification, classified in this paper, refers to the improper or illegal usage and disposal of fertilizers, pesticides, rodenticides, and chemical compounds employed during the production of cannabis and cocaine. Unregulated usage of illegal fertilizers and pesticides in illicit crop growth results in the direct poisoning of wildlife and the indirect toxification of watersheds. One calendar year in Colombia saw “81,000 tons of fertilizers, pesticides and herbicides” used in the cultivation of coca crops.¹

Toxification of watersheds, occurring either due to the disposal of cocaine, or of the chemical compounds used in its formation, raises a serious concern for the health of aquatic ecosystems and species biodiversity. A major waterway purity study conducted in Brazil revealed that cocaine occurred in higher concentrations than any other pharmaceutical compound detected.² Alone this study does not hold much substance, however, a controlled experiment conducted on the critically endangered, European Eel *Anguilla anguilla*, revealed that amphibious species sustaining prolonged exposure to cocaine in their aquatic ecosystems may suffer species decline. It is worth noting that a combination of the European Eel’s physiology and behavior place the species at a substantial risk for aquatic toxification. European Eels are sedentary, frequently residing within a constrained geographical area for up to two decades, a trait that increases their probability of bioaccumulation.³ Eels also have relatively large fat deposits, and even at extremely minute concentrations of cocaine, such as “picograms per gram”, if allowed enough time, significant bioaccumulation of cocaine into the eel’s tissue can occur.⁴ However, the threat of waterway toxification is still applicable to migratory species as well due to the short time frame required for bioaccumulation to occur. In as short of a time-span as a single month, cocaine was revealed to be present in the tissue of European

¹ United Nations Office on Drugs and Crime, “Cocaine,” *World Drug Report 2015*. (May 2015), 56.

² Thomas, Araújo Da Silva, Langford, Leão De Souza, Nizzeto, and Waichman. "Screening for Selected Human Pharmaceuticals and Cocaine in the Urban Streams of Manaus, Amazonas, Brazil," *Journal of the American Water Resources Association* 50, no. 2 (2014): 302-08.

³ Capaldo, Valiante, De Falco, Lenzi, Laforgia, Maddaloni, and Gay. "Presence of Cocaine in the Tissues of the European Eel, *Anguilla Anguilla*, Exposed to Environmental Cocaine Concentrations." *Water, Air, & Soil Pollution* 223, no. 5 (2012): 2137-143.

⁴ Ibid.

Eels.⁵ Prolonged exposure to waterborne cocaine particles has the potential to severely impact the dopamine receptors of European Eels, inhibiting their reproductive processes and reducing the overall reproductive fitness of the species.⁶

While the effects of the study conducted by Capaldo et al. were focused solely on the European Eel, a species which does not occur in the Amazon, the study reveals the risks associated with cocaine that indigenous bottom dwelling species of the Amazon Basin face. The five families of catfish in the Amazon Basin, are therefore threatened by cocaine runoff due to the comparative physiological structures and behaviors that they share with *Anguilla*; including their excessive intake of environmental particles, as a consequence of filter feeding, and substantial bioaccumulation of ingested pollutants, due to sizable fat deposits. Additionally, a recent controlled study analyzing the effects that cocaine-polluted waters had on Zebra mussels, revealed that damage to mussel hemocytes and chromosomal aberrations begin occurring within an exposure time as short as 72 hours.⁷ Exposure to the cocaine-polluted waters also induced an increase in the number of apoptotic cells and levels of necrosis.⁸ Similarly to the European Eel, while Zebra mussels are non-indigenous to South America, their shared physiology with native freshwater South American mussel species reveals the potential impacts of cocaine pollution. While more data needs to be collected to establish a substantial relationship between the effects of cocaine runoff on a wider variety of native species, there exists significant evidence of the threats that aquatic species face in areas toxified by cocaine.

The most immediate threat facing wildlife, due to illicit drug production, is the usage of rodenticides by crop growers. Cocaine, and especially marijuana growers, frequently employ anticoagulant rodenticides in an attempt to protect their crops from “pest” species. While rodenticides are commonly used in regulated crop production, the type of second-generation anticoagulant formulas illegally possessed by cocaine and cannabis cultivators have the potential to produce devastating ecosystem level impacts. The risks posed by second-generation rodenticides occur in forms of direct and indirect mortality, as well as, direct and indirect poisoning. Direct mortality of wildlife occurs through the actual consumption of these anticoagulant rodenticide compounds, which even at very low levels of exposure, can result in internal hemorrhaging and organ failure. Non-lethal exposures still frequently result in indirect mortality as a side effect of lowered immunological abilities, development of neurological disorders, and failure of thermoregulatory control.⁹

⁵ Ibid.

⁶ Ibid.

⁷ Binelli, Pedriali, Riva, and Parolini. “Illicit Drugs as New Environmental Pollutants: Cyto-genotoxic Effects of Cocaine on the Biological Model *Dreissena Polymorpha*,” *Chemosphere* 86, no. 9 (March 2012): 906-11.

⁸ Ibid.

⁹ Thompson, Sweitzer, Gabriel, Purcell, Barrett, and Poppenga, "Impacts of Rodenticide and Insecticide Toxicants from Marijuana Cultivation Sites on Fisher Survival Rates in the Sierra National Forest, California." *Conservation Letters*, 7: 91–102.

The extreme potency of second-generation rodenticides can produce a high risk for secondary poisoning to animals that scavenge on or consume poisoned individuals. A recent study conducted by the California Department of Fish and Wildlife found that 70% of animals sampled “tested positive for AR exposure.”¹⁰ Risks to wildlife also exist through the consumption of over-fertilized vegetation, which absorbs rodenticide compounds, and thus exposes herbivores to the threat of secondary-poisoning as well. During the United States’ Drug Enforcement Administration’s, *Operation Full Court Press*, over 5,445 pounds of fertilizer, and 260 pounds of rodenticides were discovered in grow sites in Northern California alone.

Overall, there exists an immense difficulty in the ability to discriminate between the detrimental effects of pesticide usage between legal and illegal marijuana cultivators. This challenge arises from the discrepancy in the legal status of marijuana harvesting, which, while legalized in numerous states, remains classified as illegal in Federal law. As a result of the conflicting legal interests, the Environmental Protection Agency has not processed, identified, or approved any pesticides for usage on marijuana crops and as such there is an occurrence of unregistered pesticides on marijuana crops which “may have unknown health consequences, as no pesticides have undergone complete risk assessments for use on marijuana at this time.”¹¹ Laws governing the usage of pesticides on marijuana crops are instead constructed through various state agencies that follow different procedures and regulations. However, in their legalization processes, many states “do not explicitly mention pesticides in their legislation on cannabis” and therefore different administrative actions and legislation must be retroactively enacted.¹²

While there exists incomplete and easily accessible data referring to the differentials of pesticide usage between illegal and legal producers of marijuana, especially due to the concealed operations of illicit growers, recent bans of the most toxic rodenticides in California will help reveal the variations as illegal growers will still be utilizing banned compounds. In 2014, California banned rodenticide materials containing the active ingredients brodifacoum and bromadiolone.¹³ The importance of this legalization is revealed in the fact that the California Department of Pesticide Regulation, when conducting their analysis of toxified wildlife, found 69% of affected individuals containing residues of brodifacoum and 37% containing bromadiolone residues.¹⁴ However, to realize the full impacts of this decision an updated survey of poisoned California wildlife would be needed, The results of this survey would then help to reveal the discrepancies between the different detrimental effects that pesticide use in regulated

¹⁰ Ibid.

¹¹ United States Environmental Protection Agency. "Pesticide Use on Marijuana." Environmental Protection Agency. January 27, 2016.

¹² Stone. "Cannabis, Pesticides and Conflicting Laws: The Dilemma for Legalized States and Implications for Public Health." *Regulatory Toxicology and Pharmacology* 69, no. 3 (August 2014): 284-88.

¹³ California Department of Fish and Wildlife. "Rodenticides." 2016.

¹⁴ Ibid.

marijuana crops produce when compared to their illegal counterparts who are operating without regulation and likely still utilizing these compounds.

Habitat Destruction

Illicit drug production is associated with greenhouse gas emissions and toxification, both of which result in ecosystem degradation, however, habitat destruction as I refer to it in this paper, focuses on the removal and destruction of physical habitat within ecosystems. Specifically, I am interested in revealing the effects of “clearcutting” and “slash and burn” practices utilized when clearing areas for marijuana and coca crops. Processing land for drug crops frequently involves the clear-cutting of intact forests in order to open up areas for plantation. Coca plantations in the 20th century accounted for approximately 7 million hectares of deforestation in the Peruvian Amazon.¹⁵ Trends going into the 21st century reveal that this destruction is still rampant; from 2001-2013 over 290,000 hectares of forest were lost due to processes of cocaine manufacturing.

A specific concern of this destruction is that much of the habitat destroyed for drug crops lies inside biodiversity hotspots like the northern-Andean ecosystem, which is singly “the most species-rich region on Earth.”¹⁶ These remote areas are chosen since they happen to be ideal spots for illegal plantations, due to their locations far from urban areas and potential detection. In the aftermath of deforestation, there follows increased levels of erosion and the loss of nutrient-rich topsoils, as well as an elevated exposure of species to predation risks and climatic stressors. The deforestation that occurs for coca and marijuana plantations is frequently correlated with “slash and burn” agriculture, making the already destructive practices exponentially more problematic. When trees are felled during a forest clear-cut, not only are they unable to continue sequestering carbon, but the carbon that they have accumulated for decades is then also released into the atmosphere when the trees are incinerated. The production of illicit drugs therefore has an effect beyond the ecosystem level, as plantation efforts further complicate the impacts of greenhouse gasses and climate change. While an in-depth and detailed description is not given here, it is obvious that the loss of old growth forests is a serious risk to the biodiversity and climatic conditions of the world.

¹⁵ Dourojeanni, Marc. "Environmental Impact of Coca Cultivation and Cocaine Production in the Amazon Region of Peru." (n.d.). *United Nations Office on Drugs and Crime*. Jan. 1992.

¹⁶ United Nations Office on Drugs and Crime, “Cocaine,” *World Drug Report 2015*. (May 2015), 56.



Deforestation in the Brazilian Amazon representative of South American clear-cutting for cocaine plantations. (Image Courtesy of Purdom and Nokes 2014)

Watershed Depletion

An often overlooked, but serious concern of marijuana growth, is the high intensity water usage of marijuana crops. A single marijuana plant uses between 8-10 gallons *per plant, per day*. In perspective, cannabis plants require almost double the amount of water than do grapes or tomatoes.¹⁷ In drought susceptible regions like California, where 70% of U.S. consumed marijuana is grown, marijuana production is exacerbating one of California's most serious concerns. In 2012, 870,477 illegal plants were removed from U.S. National Forests in California. Based on this extremely limited and incomplete data, which omits legal marijuana crops, illegal crops that were not discovered, and illegal crops that were removed, but not on National Forest lands, it can be estimated that in 2012 there was *at least* 3,177,241,050 gallons of water used in the cultivation of Californian marijuana. Data from 2010-2015 revealed that during this time span there was up to a 100% increase in marijuana crop production in northern California alone.¹⁸

Emissions and Energy

This paper does not attempt to fully cover the impact of carbon emissions produced by indoor marijuana production, but it will briefly address it. As the

¹⁷ Seaman and Park. "The Environmental Impacts of Marijuana in California." *Center on Food Security and the Environment*. 8 July 2015.

¹⁸ *Ibid.*

legalization of medical and recreational marijuana exponentially expands throughout the United States, it is imperative that the government engages in intensive monitoring of the production and emissions of legal marijuana crops. Currently, the average production of 1 kilogram of consumable marijuana results in 4,600 kilograms of carbon dioxide emissions; in perspective, each cannabis “joint” produced at an indoor facility is the result of three pounds of carbon dioxide emissions.¹⁹ Within a single year, approximately 15 million metric tons of carbon dioxide are emitted in the United States as the result of indoor cannabis production, an equivalent to the annual emissions of 3 million cars.²⁰



Common appliances of indoor cannabis growing facilities responsible for carbon emissions. (Image Courtesy of Mills, 2012)

SOLUTIONS

Change of Approach

Efforts by federal agencies, like the Drug Enforcement Administration, up to this point, have been focused mainly on stopping the importation, smuggling, sale, and consumption of illicit drugs. This reactive approach of enforcement occurs post drug production, after significant environmental damage has been incurred. It is necessary for a strategic switch to a more preventive, environmentally-focused approach, that is directed at the public, consumer bases, and law-makers, and focuses on stopping production in its initial stages. By engaging these focal groups, enforcement efforts can rally support from environmental agencies, non-government organizations, and nature advocates. Seeing the strong influence of the widespread “green” and environmental movements, it seems reasonable that an appeal to the ethos of nature may be a valid

¹⁹ Mills, Evan. "The Carbon Footprint of Indoor Cannabis Production." *Energy Policy* 46 (2012): 58-67.

²⁰ Ibid.

alternative to the outdated approach of drugs as a “detriment to society”. With the economic support and coordination of intellectual and technological resources, enforcement and environmental agencies, as well as nature advocates, can work in tandem to streamline their preventive efforts aimed at stopping environmentally destructive production processes.

Cooperation

The primary solution required for successfully resolving the global and multi-faceted issue of drug production, is to improve upon international and intra-state agency cooperation. The concept presented here is not intricate. Simply stated, while limited cooperation does exist between countries, agencies, and via international organizations, like the United Nations, the amount of integration required to accurately address this issue is currently insufficient. Permanent integration is required between these organizations. The current cooperative efforts focused on specific temporal operations are not enough to stem this profound issue that has continually persisted for decades. Intrastate agencies such as the United States Forest Service, Federal Bureau of Investigation, Bureau of Alcohol, Tobacco, Firearms, and Explosives, Central Intelligence Agency, and Drug Enforcement Administration need to fully incorporate their efforts in regards to domestic and international drug control. Internationally, these domestic agencies, led by the initiative of the Executive Branch and the United States Senate, need to establish close links with their counterparts in major cocaine trafficking and growth countries such as Bolivia, Colombia, and Peru. An example of the success that can stem from intimate cooperation between nations is highlighted by the combined efforts of the United States and Colombia in “Plan Colombia”. A highlight of the cooperation occurred from 2009-2010, when the operation, which closely intertwined multiple agencies and resources of both nations, was able to remove 16,000 hectares of coca plantations, the equivalent of 14% of total Colombian cultivation.²¹

Advertisement and Public Information

While federal outreach programs, such as the Office of National Drug Control Policy’s “Above the Influence” campaign, have addressed marijuana and drug usage in the past through commercial advertisements, the approach used has long been outdated and in need of revision. While the Office of National Drug Control Policy is no longer in oversight of “Above the Influence”, future attempts by the U.S. government or non-government organizations will require an adjustment of focus.

The United States stands as the world’s largest consumer of cocaine.²² Additionally, a 2013 study of marijuana consumption revealed there to be approximately

²¹ United States of America. Department of State. *U.S. Bilateral Relations Fact Sheets: Colombia*. March 6, 2012.

²² Central Intelligence Agency, “Illicit Drugs” *The World Factbook* 2013-14.

20 million frequent users of cannabis in the U.S.²³ Anti-drug advertisements need to redress their approach by combining traditional health issues with the impacts of environmental destruction that results from cannabis and cocaine production. These campaigns also must make an overt appeal to drug consumers, indicating how they are *personally* contributing to ecosystem degradation by electing to use these recreational drugs, thus propelling the drug-trade. A new advertising approach focused on enlightening voting constituents and consumers about the environmental damages of marijuana and cocaine production may help reveal issues to the public that they were formerly unaware of, but have vested interests in. Public issue campaigns revealing the determinants that cannabis and cocaine bring to species and ecosystems may prove to be a more substantial deterrent to consumers than the traditional appeals advocating that one should avoid drugs because they are “bad, illegal, and dangerous for your health.”²⁴

Even if these campaigns are not guaranteed to be effective at declining the consumer base, by exposing to the public and nature advocates the severe impacts brought about by cannabis and cocaine production, an avenue is opened for voters to channel their concerns and appeal to their legislators. State and Federal Congressional members not only have an incentive to follow their constituents’ will, but will also have the power to enact meaningful legal change. Petitions and appeals to legislative bodies such as the Energy and Natural Resource Committee, Caucus on International Narcotics Control, Foreign Affairs Committee, Committee on Homeland Security and Governmental Affairs, Environmental and Public Works Committee, Agriculture, Nutrition, and Forestry Committee will help address issues of cooperation, enforcement, prevention, and regulation. By appealing to the environmental issues of drug production, enforcement agencies can expand their targeted audience and accrue a wider base of support, thus improving their ability to resolve the multifaceted concerns of cannabis and cocaine production.

Revision of Enforcement and Preventive Measures

The main purpose of this paper is to enlighten readers about the non-transparent issues of environmental damage resulting from the drug trade of cocaine and cannabis, and to encourage the integration and cooperation of concerned groups. Provided below are some feasible strategies that could possibly be invoked in future efforts.

One of the most practical solutions available would involve the implementation of stricter regulations and enforcement methods for existing and proposed legalized marijuana plantations and facilities. Specifically, there needs to be a detailed review and inspection of greenhouse gas emissions, as well as, the use and disposal of fertilizers and pesticides by certified growers. As the United States continues to expand the number of

²³ National Institute on Drug Abuse, "What Is the Scope of Marijuana Use in the United States?" *The Science of Drug Abuse & Addiction*, Sept. 2015.

²⁴ *Ibid.*

states that accept the usage of medicinal and recreational marijuana, there needs to be an adaptation of “environmentally friendly” methods of growing, especially in regards to pesticide usage. Whether through solar energy or direct sunlight and natural fertilizers, if legislators are willing to accept the legalized consumption of marijuana in their states they need to also enforce its environmental impacts as well.

In regards to the illegal cultivation of cocaine and cannabis, it is imperative that plantation detection and removal methods continue to improve via the implementation of the most advanced technology available. Through the aforementioned incorporation of environmental and enforcement objectives, the overall amount of funding allocated towards preventative enforcement measures will increase. This increase in funds, whether from legislatures expanding budgets, or from private donors and interest groups, will expand the array of options available for developing more economically efficient, and environmentally sound, detection and removal methods. The development of more numerous and effective aerial detection devices, whether in the form of manned or unmanned aircraft, provides a rational solution geared towards monitoring remote regions and identifying where clear-cutting and plantation is occurring, allowing for termination during the initial stages of production. A notable success of aerial detection, and spraying, of coca crops occurred in the combined U.S. and Colombian operation “Plan Colombia”, where sustained aerial operations were “credited” with the operation’s successful removal of 16,000 hectares of Colombian coca plantations.²⁵ However, it is also imperative that there continues to be an evolution of the chemical compounds and pesticides designed to thoroughly exterminate illicit drug crops. Compounds used in the eradication of plantations will continue to have an antithetical effect if they do not simultaneously leave surrounding wildlife, humans, and vegetation unharmed. Finally, by integrating interest groups and concerned citizens into removal processes, governmental organizations can acquire the man-power required to properly dispose of the materials and waste accumulated on cleared plantations; a task typically undermanned and poorly executed.

Regarding the societies of nations affected by illicit drug trading, there exists a necessity for the rebuilding of society and reintegration of civilians. Even if crop production is significantly curtailed, without a successful rebuilding process, societies will face issues of adjustment towards legal agricultural, and possibly risk a reversion to the now normalized practices of illicit drug cultivation. A prime example of what this process entails is provided by Colombia’s “National Consolidation Plan,” which is working to involve and reintegrate Colombian citizens who have been forced into the drug trade, whether out of necessity or violence. With the assistance of the United States, the Colombian government has started eradicating drug crops and subsequently loosening the grips of rebel groups and narcotic organizations, like the Revolutionary Armed Forces

²⁵ United States of America. Department of State. *U.S. Bilateral Relations Fact Sheets: Colombia*. March 6, 2012.

of Colombia People's Army. As these organizations lose their drug supplies, which compose the majority of their incomes, they also lose their ability to exact a stranglehold over local populations. However, since these citizens have been adjusted to violence and forced into illegal methods of raising revenues, such as cultivating coca crops, they require assistance to be reintegrated into society and in reverting back to traditional forms of agriculture.²⁶ Without demilitarization and reintegration, not only will citizens be unable to confirm to, and thrive in, a legalized society, but many of the former large cartel operations will likely end up splintering into smaller local operation, continuing environmental and societal degradation. To help prevent this type of situation from occurring, the United States Agency for International Development and the Colombian government have worked to implement "livelihood projects" that go beyond illicit crop eradication and include "enterprise development, natural resource protection, institutional strengthening, and promoting access to markets."²⁷ Both nations have also worked to introduce drug prevention programs throughout the nation and to reform and improve the legal and judicial systems.²⁸

CONCLUSION

When considering all those impacted by the illegal production of cannabis and cocaine, one must take into account the wide expanse of stakeholders. A partial list of these stakeholders is as follows: animal species, plant species, environmentalists, anti-drug advocates, lobbyists, landowners, citizens, law enforcement, drug agencies, governments, and international organizations. Essentially, any person or animate object negatively affected by drug production, trafficking, selling, or use, is suffering *because* of the plantation, cultivation, and manufacturing processes. These effects occur in both direct, and indirect forms. Direct effects caused by the production of cocaine and cannabis include: the clear-cutting of forests, the intentional poisoning of plant and animal species, the toxification and depletion of watersheds, and the emission of greenhouse gasses and air pollutants. Indirect effects of marijuana and cocaine production include: biodiversity loss, ecosystem degradation, drug trafficking, theft, violent crime, drug addiction, drug enforcement and treatment costs, and government destabilization.

If the initial, and environmentally destructive, production stages of cannabis and cocaine ceased to transpire, there would exist no physical and useable form of these drugs. Without a consumable form, none of the aforementioned indirect issues would occur as a result of the direct effects of cocaine and cannabis cultivation. The first step to revitalizing our approach towards stopping environmental damage, resulting from drug

²⁶ Ibid.

²⁷ Ibid.

²⁸ Ibid.

production, is to create intrastate and international networks that combine the abilities of the two types of agencies with the most at stake, law enforcement and environmental. By combining the resources and talents of various organizations, we can increase the funding and efficiency of efforts focused on preventing ecosystem degradation and illicit drug production. Through raising public awareness of the environmental impacts of illicit drug production, we can stem the consumer base for these drugs while concurrently raising legislative support from concerned constituents. If afflicted parties, regardless of their national or organizational identifications, wish to sincerely resolve this enduring issue, cooperation will be required.

“Coming together is a beginning; keeping together is progress; working together is success.” - Henry Ford

BIBLIOGRAPHY

- Binelli, A., A. Pedriali, C. Riva, and M. Parolini. "Illicit Drugs as New Environmental Pollutants: Cyto-genotoxic Effects of Cocaine on the Biological Model *Dreissena Polymorpha*," *Chemosphere* 86, no. 9 (March 2012): 906-11.
- California Department of Fish and Wildlife. "Rodenticides." California Department of Fish and Wildlife. 2016.
- Capaldo, Anna, Salvatore Valiante, Maria De Falco, Mauro Lenzi, Vincenza Laforgia, Massimo Maddaloni, and Flaminia Gay. "Presence of Cocaine in the Tissues of the European Eel, *Anguilla Anguilla*, Exposed to Environmental Cocaine Concentrations." *Water, Air, & Soil Pollution* 223.5 (2012): 2137-143.
- Central Intelligence Agency, "Illicit Drugs" *The World Factbook* 2013-14.
- Daniels, Deborah. *Second Generation Anticoagulant Rodenticide Assessment*. California Department of Pesticide Regulation. June 27, 2013.
- Dourojeanni, Marc. "Environmental Impact of Coca Cultivation and Cocaine Production in the Amazon Region of Peru." (n.d.). *United Nations Office on Drugs and Crime*. United Nations, 1 Jan. 1992.
- Executive Administration of Barack Obama, *Marijuana on Public and Tribal Lands*. Office of National Drug Control Policy, 2012.
- Mills, Evan. "The Carbon Footprint of Indoor Cannabis Production." *Energy Policy* 46 (2012): 58-67.
- Mourad W Gabriel, Woods LW, Poppenga R, Sweitzer RA, Thompson C, et al. (2012) "Anticoagulant Rodenticides on our Public and Community Lands: Spatial Distribution of Exposure and Poisoning of a Rare Forest Carnivore." *PLoS ONE* 7(7).
- National Institute on Drug Abuse, "What Is the Scope of Marijuana Use in the United States?" *The Science of Drug Abuse & Addiction*, Sept. 2015.
- Power, Mary. "The High Environmental Cost Of Illicit Marijuana Cultivation." Interview by Diane Toomey. *Yale Environment* 360. Yale University, 16 July 2015.
- Purdom, Rebecca, and Kelly Nokes. "Brazil Repeals Forest Code and Deforestation Accelerates." *Vermont Law Top Ten Environmental Watch List 2014*. Vermont Law School, 2014.

- Seaman, Laura, and Lisa Park. "The Environmental Impacts of Marijuana in California." *Center on Food Security and the Environment*. Stanford University, 8 July 2015.
- Security and Emergency Management Department of the Interior, *Marijuana Cultivation*, 112th Cong. (2011) (testimony of Kim Thorsen Deputy Assistant Secretary, Law Enforcement).
- Stone, Dave. "Cannabis, Pesticides and Conflicting Laws: The Dilemma for Legalized States and Implications for Public Health." *Regulatory Toxicology and Pharmacology* 69, no. 3 (August 2014): 284-88. Accessed May 11, 2016.
- Thomas, Kevin V., Felipe M. Araújo Da Silva, K.H Langford, Afonso D. Leão De Souza, L. Nizzeto, and A.V. Waichman. "Screening for Selected Human Pharmaceuticals and Cocaine in the Urban Streams of Manaus, Amazonas, Brazil." *Journal of the American Water Resources Association* 50.2 (2014): 302-08.
- Thompson, C., Sweitzer, R., Gabriel, M., Purcell, K., Barrett, R. and Poppenga, R. (2014), "Impacts of Rodenticide and Insecticide Toxicants from Marijuana Cultivation Sites on Fisher Survival Rates in the Sierra National Forest, California." *Conservation Letters*, 7: 91–102.
- United Nations Office on Drugs and Crime, "Cocaine," *World Drug Report 2015*. May 2015.
- United States of America. Department of State. *U.S. Bilateral Relations Fact Sheets: Colombia*. March 6, 2012. Accessed May 11, 2016.
- United States Environmental Protection Agency. "Pesticide Use on Marijuana." Environmental Protection Agency. January 27, 2016. Accessed: (<https://www.epa.gov/pesticide-registration/pesticide-use-marijuana>), May 08, 2016.