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# Environmental Crime and Victimization: A Green Criminological Analysis of the Endosulfan Disaster, Kasargod, Kerala

Faisal Melangadi\*

Department of Criminology, University of Madras, Chennai – 600 005, Tamil Nadu, India

\*Corresponding Author: Faisal Melangadi, UGC Junior Research Fellow, Department of Criminology, University of Madras, Chennai – 600 005, Tamil Nadu, India. E-mail: faisalmelangadi@gmail.com

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## Abstract

Pesticides are chemicals used to kill pests and other “rival” organisms which may cause damage to crops in agriculture. In some instances the vast usage of pesticides may create negative effects on the environment and its units like living and non-living organisms. Green criminology counts such harmful activities upon the environment as crimes or harms though such activities can be legal or illegal in nature. The case of the endosulfan disaster that occurred in Kasargod, Kerala can be accounted to environmental harms which detrimentally affected the environment and its units, especially humans. The pesticide endosulfan was sprayed aerially for around 25 years in cashew plantations situated in Kasargod and caused severe diseases and extensive malformations among people living in the region. In this paper the endosulfan disaster of Kasargod is approached through the green criminological perspective of environmental harms.

**Keywords** green criminology; environmental crime; endosulfan; health consequences

## INTRODUCTION

Pesticides are mainly used to kill organisms which damage crops, thus aiming to increase crop production. Lynch et al. (2013, pp. 1010–11) point out that the “liberal application of pesticides kills other species and changes how nature works, often leaving long-lasting toxins in the environment”. The extensive use of pesticides severely harms the environment, including the ecosystem and all living organisms – human and non-human – and the consequences of such harms may last for several years and even future generations may be affected. The pesticide endosulfan was aerially sprayed with an objective to eradicate “tea mosquitoes” from cashew plantations spread over several village panchayats of the Kasargod district in Kerala. The continuous application of endosulfan, for around 25 years, created serious impacts on the environment and living organisms and exposure to endosulfan was reflected in humans in the form of severe diseases.

Green criminology handles studies of environmental harms and crimes inflicted upon the environment, i.e. the ecosystem, and human and non-human units living on it. Most of the time, environmental harms are not illegal but are morally questionable, socially unacceptable or widely debated (Pearce and Tombs 1998, as cited by Lynch and Stretesky 2001). Green criminology argues that every action which has a negative impact on the environment, humans and other organisms would be considered as an environmental crime or a green crime (see Lynch and Stretesky 2001; Potter 2012). Such harmful actions victimize a large number of humans and non-human fractions of nature and the whole environment itself. This article portrays how agricultural pesticide usage poses a threat to humanity and how badly it affects the people living in the area of application, using the endosulfan disaster in Kasargod as a catalyst, taking green criminological concepts of environmental harm into account. A descriptive analysis method is employed in this study to analyse the practice of endosulfan application and victimization caused due to exposure to the pesticide.

### GREEN CRIMINOLOGY, ENVIRONMENTAL CRIME AND HARMS

Environmental crime came into the limelight after realizing the intensity of harmful activities on the environment mainly in the form of discharge of harmful substances into the air, water and soil (collectively, polluting the environment), deforestation, mining, etc. Havoc as a result of climate change led to thinking specifically about harms/crimes against the environment and violations of laws meant to protect the environment. This resulted in the development of a new school in criminology known as green criminology which studies crimes or harms committed against the environment, violations of environmental laws and so on. Potter (2012) explains green criminology as the analysis of environmental harms or crimes from a criminological perspective and the application of criminological thought to environmental issues. This means thinking about offences (what crimes or harms are inflicted on the environment, and how), offenders (who commits crime against the environment, and why) and victims (who suffers as a result of environmental damage, and how), and also about responses to environmental crimes: policing, punishment and crime prevention (Potter 2012). Green criminology “explores green crimes and harms from an ecological vantage point, where harms and crimes committed against ecological units and the species living in those units are studied” (Lynch et al. 2013, p. 997).

Harmful activities inflicted on the environment are known as environmental crimes, committed with or without the intention to cause damage or harm to the environment which subsequently harm the living organisms in the ecosystem. Gibbons (1994) postulates that environmental crime is an intentional or well-considered criminal act, resulting in the actual and material damaging of water, environment, air, soil or countryside. Nellemann et al. (2016, p. 17) states that environmental crime:

is most commonly understood as a collective term to describe illegal activities harming the environment and aimed at benefitting individuals or groups or companies from the exploitation of, damage to, trade or theft of natural resources, including, but not limited to serious crimes and transnational organized crime.

The legal perspective of environmental crime posits that violations of environmental protection statutes and laws designed to protect the health and safety of people, the environment or both are considered as environmental crime (Clifford and Edwards 1998, as cited by Bradshaw 2012; Gibbs et al. 2010, cited by Hall 2013). Activities like illegal dumping of wastes – including hazardous and chemical wastes, illegal logging of trees, trade of endangered wildlife species, smuggling of ozone-depleting substances and nuclear wastes, illicit trade of hazardous waste, the destruction of natural flora and fauna, pollution, landscape degradation and radiation hazards; negative impacts on arable land, economic crops and trees, illegal extraction and trade in minerals, etc. are counted as environmental crimes (Nellemann et al. 2016; United Nations Interregional Crime and Justice Research Institute (UNICRI) n.d.).

Green criminology comprises the studies of crimes committed against humanity through environmental destruction, examinations of the successes and failures of governments and corporations to protect humans and animals from environmental hazards, or the study of specific governmental and corporate practices and social trends that destroy the environment and thereby threaten the survival of humans, plants and animals (Lynch 1990, as cited by Bradshaw 2012). Green criminology also studies victims of environmental harms and crimes, i.e. those who suffer as a result of environmental damage, and how (Potter 2012). There are generally two kinds of victims, in the case of humans, the direct victims and indirect victims. The direct victims are the identifiable ones, for example, in the case of the Bhopal gas tragedy, 1984, thousands died and were injured (Wikipedia 2016a); here they are the immediate and direct victims of an environmental harm. Indirect victims of environmental crimes/harms, in some instances, are the general public, to say, the other side of the globe suffering from climate change or global warming and related issues due to deforestation or industrial pollution occurring in the another half, since the ecosystem covers the Earth. For example, the practice of illegal logging and deforestation of huge areas of tropical rainforest for the oil palm industry in Indonesia made the country the third highest emitter of greenhouse gases, especially carbon dioxide (Faisal 2017), which has its own repercussions in global warming and climate change and related victimization.

### **THE PESTICIDE ENDOSULFAN**

Pesticides are chemical or biological agents that deter, incapacitate, kill or otherwise discourage pests such as weeds, fungi or insects to protect the plant or crops (Wikipedia 2016b). Modern pesticide history is much linked to the Second World War in which pesticides were primarily formulated with the intent to use them as warfare agents (Lah 2011; Saleem 2011). During the 1930s and by the early 1940s, a range of new pesticides had been developed, including organochlorine insecticides like dichlorodiphenyltrichloroethane (DDT). In 1937 a group of German chemists developed the first organophosphate compounds as potential chemical warfare agents and these very potent compounds were kept secret (Lah 2011). After the war, these organophosphate compounds, being useless, were re-purposed as insecticides and many such organophosphate insecticides continue to be used to the present day (Jayakumar 2011; Lah 2011). The green revolution and modern agricultural industry incorporated with capital interests of greed and profit triggered the vast and blind use of pesticides in agriculture. Many studies point out that the “green revolution” was a

tactical movement to make those pesticides popular with agriculture and to save the industry (Saleem 2011).

Pesticides and chemical fertilizers started being used in Kerala as a part of the “Indian green revolution”. One of the main focuses was paddy cultivation intended to increase rice production in the state. To attain this high productivity, the State Agriculture Department supplied high-yielding rice varieties (such as IR8, Aathira, Jaya, etc.), pesticides like DDT, benzene hexachloride (BHC) and Sevin and fertilizers like urea, potash and Factomphos to farmers through various regional and local Agriculture Development offices (Leelakumariamamma 2011). Sevin is the brand name of carbaryl which Union Carbide developed and introduced commercially in 1958 (Wikipedia 2016c). The Union Carbide India Limited pesticide plant in Bhopal, Madhya Pradesh, produced Sevin using methyl isocyanate (MIC) as an intermediate. The leak of MIC gas led to the Bhopal disaster on December 4, 1984 where 8,000 persons died and there were 558,125 injuries (Wikipedia 2016a). Thus, the Bhopal disaster, one of the worst industrial disasters in India, is correlated with the green revolution (Leelakumariamamma 2011).

Endosulfan is an off-patent organochlorine insecticide and a persistent organic pesticide that can be used on a wide variety of vegetables and fruits, cotton and ornamental plants (United States Environmental Protection Agency 2010; Wikipedia 2013). It was developed in early 1950s and was first used as a pesticide in the United States in 1954 to control agricultural insects and mite pests on a variety of field, fruit and vegetable crops (Endosulfan RED Facts; United States Environmental Protection Agency 2002). Estimated in 2011, around 70% of endosulfan in the world market was manufactured in India (approximately 9,000 tons per year worth \$300 million) and half of it was bought by the country’s 75 million farmers, making it the world’s largest consumer of endosulfan (Pulla 2011).

Numerous laboratory and greenhouse studies have shown that endosulfan is strongly adsorbed to soil and remains for weeks (Silva 2007). Endosulfan can drift after aerial application and can be transported long distances through the air. Hence bystander populations (non-occupational) could potentially be exposed to endosulfan in ambient air (Silva 2007). It can be accumulated in marine fish, freshwater fish, vegetables, etc. and can reach humans through the food chain (Silva 2007). It also enters the human body through direct exposure to the skin, through drinking water, by breathing the air where it has been sprayed, etc. (Harikrishnan and Usha 2004).

Endosulfan is highly toxic and can be fatal if inhaled, swallowed or absorbed through the skin; acute oral toxicity is higher than dermal toxicity and endosulfan directly affects the central nervous system and the reproductive system (Harikrishnan and Usha 2004). The United States Environmental Protection Agency and the European Union have classified endosulfan as “highly hazardous”, whereas the Industrial Toxicological Research Centre (ITRC) in India and the United Nations Environment Programme-Global Environment Facility (UNEP-GEF) have classified endosulfan as “extremely hazardous” (Harikrishnan and Usha 2004). Due to its toxicity, potential for bioaccumulation, and role as an endocrine disruptor, and cancer causing, endosulfan has become a highly controversial agrichemical. Many countries have taken action to end the use of endosulfan because of the health risks caused by it to farmworkers and wildlife and its persistence in the environment (United States Environmental Protection Agency 2010). The Stockholm Committee for Persistent Organic Pollutants (POPs) considered endosulfan as a POP in 2009 and recommended

a global ban at the meeting held in April 2011, in Geneva (United Nations Environment 2011). In India, considering the ill effects caused by endosulfan, the Supreme Court of India banned the production, storage, sale and use of the pesticide in May, 2011 (Writ Petition (Civil) No. 213 of 2011, Supreme Court of India).

### **AERIAL SPRAYING OF ENDOSULFAN IN KASARGOD**

Kasargod, the northern district of Kerala, India, is one of the most important parts of the Western Ghats where numerous hills are located with thick forests. The land is peculiar with 13 rivers, numerous water sources like surangams (naturally formed tunnel wells; they are traditional ground water sources cut deep into the hills), wells and bores, more than 15 native communities (Adivasis), seven languages, and eight fortresses made by early civilizations, etc. (Rahman 2011). The Plantation Corporation of Kerala Ltd (hereafter PCK) is the largest plantation company in the public sector formed in 1962, by the Government of Kerala under the Ministry of Agriculture to accelerate the agro-economic development of Kerala (The Plantation Corporation of Kerala Ltd n.d.). As part of the Kerala green revolution, the PCK engaged in mono-crop cultivation in Kasargod, i.e. setting up cashew tree plantations by cutting down trees on a large scale and eliminating other crops which were cultivated before in those areas (Rahman 2011). Large-scale mono-crop cultivation will change the balance of the environment by affecting soil fertility and living organisms in the soil (Faisal 2017). Rahman (2011) pointed out that mono-crop cultivation of cashews endangered the agricultural pluralism of the area and deeply harmed the environment.

PCK owned cashew plantations with an area of 4715 hectares which spread over 11 village panchayats<sup>1</sup> in Kasargod (National Institute of Occupational Health (NIOH) 2002; Saleem 2011). The cashew plantations were situated in hill areas where they were spread in isolated patches intertwined with human habitations. There were large number of surangams and wells inside and outside the plantation area and several streams originated from there. Thus, water from the plantation could run off into the valleys inhabited by people (Committee for Government of Kerala 2001; Rahman 2011). Many schools and a large number of houses and wells were present inside and outside of the plantations (Committee for Government of Kerala 2001). Thus, the hydrology and morphology and human settlement pattern of the area make the area unsuitable for aerial spraying of any pesticide (Committee for Government of Kerala 2001).

However, during the period from 1976 to 2000, the pesticide endosulfan was aerially sprayed in the PCK's cashew plantations with the objective of eradicating "tea mosquitoes" from cashew trees (Saleem 2011). It was continuously sprayed over 25 years, three times per year (from October to February) and this led to severe health problems for people living in the area (NIOH 2002; Department of Health and Family Welfare 2011; Saleem 2011; Usha 2000). Like in the Bhopal gas tragedy, hundreds lost their lives and thousands suffered serious diseases due to endosulfan exposure in the area, along with imbalance in the ecosystem of the region (Leela-kumariamamma 2011; Rahman 2011).

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<sup>1</sup>Those 11 village panchayats are: Badiyaduka; Bellur; Enmakaje; Karaduka; Muliyyur; Kumbadaje; Ajanur; Kallar; Panathady; Kayyur – Cheemeni; and Pullur – Periya (NIOH 2002).

## RULE VIOLATIONS DURING THE APPLICATION OF ENDOSULFAN

Endosulfan was aerielly sprayed in the cashew plantations in Kasargod without following the rules set forth in the Insecticides Act, 1968, the Insecticides Rules, 1971, the Environment (Protection) Act, 1986, and the Water (Prevention and Control of Pollution) Act, 1974. The expert committee appointed by the Government of Kerala (to study the issue of suspected health hazards due to the use of endosulfan in Kasargod) observed that PCK “was not following the guidelines for the use of aerial spraying” of endosulfan in its cashew plantations (Government of Kerala 2003, p. 4). The aerial spraying of endosulfan contaminated the water bodies in the region. People living in villages where the plantation was situated experienced severe exposure to endosulfan (NIOH 2002; Rahman 2011).

Rule 43 of the Insecticides Rules, 1971 mandates that the operators shall use only approved insecticides and their formulations at approved concentration and height; all aerial operations shall be notified to the public not less than 24 hours in advance through competent authorities; and the pilots shall undergo specialization training including clinical effects of the insecticides. The District Collector gave a license to PCK on the following conditions: prior notice should be given to the public before 24 hours of application of the pesticide; all precautionary measures should be taken to prevent water pollution or health hazard to inhabitants in and around the plantation and neighbouring area as per rules and prevailing directions; before the aerial spray, PCK should cover all wells, drinking water sources in and around the locality; announcement through loudspeakers should be made 24 hours before pesticide application, instructing people to take precautionary measures at the time of spraying; PCK should by all means ensure that the spraying does not cause any environmental problems, etc. (Committee for Government of Kerala 2001).

The Committee for Government of Kerala (2001) reported that PCK had not been following the rules prescribed for aerial spraying and applied the pesticide without observing any protocol and safety rules. The same pesticide was repeatedly used for about two decades against the recommended practice of rotating different pesticides and without considering the possibility of insects acquiring immunity to endosulfan due to the long period of exposure (Committee for Government of Kerala 2001). PCK had no technically qualified staff to guide or supervise the spraying and to monitor the effects; the water bodies were never covered; and PCK did not conduct any prior studies on tea mosquitoes in the region even though PCK applied endosulfan to eradicate tea mosquitoes from cashew plantations (Committee for Government of Kerala 2001).

The small rivers Panathur and Karicheri, fed by streams originating from or passing through the area, are tributaries of the Chandragiri River which supplies drinking water to Kasargod town and several village panchayats and the surangams from which the people draw water. They have all been contaminated by pesticide exposure (Committee for Government of Kerala 2001). According to the Insecticides Act and Rules it is not allowed to aerielly spray any pesticide over an area which contains 13 streams, numerous water sources and more than 4 lakh (400,000) people residing. However, PCK violated this by aerielly spraying endosulfan over 11 village panchayats where cashew plantations were located and continued this practice for almost 25 years, spraying three times per year (Rahman 2011). The Endosulfan Spray Protest Action Committee (ESPAC) (2001) stated that the conditions specified by the

rules, such as covering all water sources during the spraying; giving prior information or notice to the people living in the area; advising them to keep away from the area of application for a period of 20 days, etc. had been violated. The Central Insecticides Bureau (CIB)<sup>2</sup> prescribed that the spraying of endosulfan should be undertaken at the height of a maximum 3 metres from the crop canopy, but endosulfan was aerially sprayed using a helicopter more than 30 metres above ground level (Committee for Government of Kerala 2001; ESPAC 2001; Usha 2000).

In 2001 it is noticed that, from 1993, aerial spraying of endosulfan in Kasargod had been conducted without the permission of the CIB, i.e. the CIB had given approval for aerial spraying up to December 1992, but the spraying continued up to December 2000 without any permission from the CIB (ESPAC 2001). Section 24 of the Water (Prevention and Control of Pollution) Act, 1974 prohibits direct or indirect discharge of any poisonous, noxious or polluting matters into any water body. The Air (Prevention and Control of Pollution) Act, 1981 defines air pollutants<sup>3</sup> and air pollution, though it does not say anything about the air pollution due to aerial applications of pesticides. However, the aerial spraying polluted soil and water in the region (NIOH 2002; Rahman 2011). In this discussion it is clear that the practice of aerial spraying of endosulfan in Kasargod did not follow the prescribed rules, such as the Insecticides Act, 1968, the Insecticides Rules, 1971, the Environment (Protection) Act, 1986, and the Water (Prevention and Control of Pollution) Act, 1974.

#### **ENVIRONMENTAL IMPACT OF ENDOSULFAN EXPOSURE**

Leelakumariamamma (2011) observed that animals like hog rats, squirrels, etc. and birds like crows, greater coucals, etc. and insects like butterflies which were common in the area disappeared during the years of endosulfan spraying. There were other reports indicating the disappearance of fishes, frogs and snakes following the aerial spray in Kasargod (NIOH 2002; Quijano 2002). In a study conducted by Kerala State Council for Science, Technology and Environment (KSCSTE) (2011),<sup>4</sup> it was found that honey bees which were abundant in the area and a source of income for most farmers became absent during years of the spray. The area, which had been rich in faunal diversity, had lost the same and a large number of wildlife, including Nilgiri langurs, tigers, jackals, wild boar, jungle cats, mouse deer, mongooses, squirrels, flying foxes, black-naped hares, sparrows, parakeets, crows, fishes, frogs, snails, etc., present in the area disappeared when the spraying was commenced (KSCSTE 2011).

The major species of birds missing in the plantations were flycatchers, babblers, and endemic birds such as small sunbirds, crimson-throated barbets and white-bellied tree pie; common birds like fairy bluebirds, large cuckoo shrikes and large wood shrikes were also absent in the area (KSCSTE 2011). The endosulfan-sprayed area showed a decline in plant diversity between 40 and 70%, mainly of native

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<sup>2</sup>The CIB is the Central Government agency which regulates pesticide use and the agency for registering its manufacture, sale and use in India.

<sup>3</sup>“Air pollutant” means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment. Section 2 (a), Air (Prevention and Control of Pollution) Act, 1981.

<sup>4</sup>This study report was prepared in response to the direction from the Government of Kerala to assess the levels of the pesticide in soil, water and blood samples and its impacts on human health and the environment.

species, compared with the natural habitat (KSCSTE 2011); this was mainly due to the felling of numerous trees and clearing of natural flora to plant cashew trees. Rahman (2011) pointed out that hundreds of trees were illegally cut down and smuggled from the area.

Monitoring of water sources for endosulfan residue, conducted by Kerala State Pollution Control Board in 2008–2010, exposed the presence of endosulfan in water samples collected from endosulfan-sprayed areas (Kerala State Pollution Control Board 2010). Another study (KSCSTE 2011) showed that endosulfan was persistent in soil and several sediment samples even after 10 years since aerial spraying had been stopped. Blood analysis of people residing in the region showed that endosulfan residue was present in blood samples between 108 parts per million (ppm) and 196 ppm (Centre for Science and Environment 2001). Laboratory investigations done by NIOH also showed high levels of endosulfan in the serum of people, water, soil and vegetation (NIOH 2002). Another blood analysis of people conducted 11 years after the use of endosulfan had been stopped showed a high rate of endosulfan residue (Government Medical College Calicut 2011). These analyses of soil, water and blood conducted at different times show that endosulfan residue was present and persisted for a long time in the environment and human bodies and that endosulfan applications negatively affected the environment and its units.

#### **HARMS CAUSED BY ENDOSULFAN EXPOSURE IN KASARGOD**

In every environmental harm or crime, the first victim is the environment itself and then humans and other organisms are threatened (Eman, Meško, and Fields 2011; Lynch, et al. 2013). Even future generations could be the possible victims of such crimes. Green harms or crimes often victimize larger numbers of humans in a single incident (Williams 1996a, as cited by Lynch, et al. 2013). This section discusses the harmful after-effects of endosulfan exposure to the health of people living near the cashew plantations in Kasargod.

The health abnormalities (which were not present before the practice of endosulfan spraying began in the area) appeared in animals and humans in the region adjoined to cashew plantations just three years (in 1979) after PCK resorted to aerial spraying of endosulfan in Kasargod (Committee for Government of Kerala 2001; KSCSTE 2011; Quijano 2002). Various studies conducted by governmental and non-governmental agencies examining the health issues present in the area explored the linkage between endosulfan and the diseases among the population (Committee for Government of Kerala 2001; Department of Health and Family Welfare 2011; Endosulfan Victims Relief and Rehabilitation Cell n.d.; Government Medical College Calicut 2011; Government of Kerala 2003; KSCSTE 2011; NIOH 2002; Quijano 2002; Ramachandran and Mohanan 2003).

In 2001, the National Human Rights Commission, India, asked the Indian Council of Medical Research (ICMR; India's apex body for medical research) to study the health issues present in Kasargod, and NIOH, a constituent institution of the ICMR, conducted an environment epidemiological study. The two important conclusions of that study are:

1. There is a significantly higher prevalence of neurobehavioural disorders, congenital malformations in female subjects and abnormalities related to the



male reproductive system in the study group (Padre village, Enmakaje Panchayat) as compared with the reference group (Miyapavadu village of Meenja Panchayat).

2. Regarding the aetiological factors, responsible for these health problems, various factors were compared and it was found that the two groups differed mainly with respect to aerial spraying of endosulfan. Therefore the most probable cause for the health problems in the study area could be the relatively high and continued exposures to endosulfan through various environmental media such as food, water, soil and air. (NIOH 2002, p. 49)

NIOH (2002, p. 51) pointed out that “the possibility of endocrine disrupting effect of endosulfan observed in the study has great relevance to the health of the future generations”.

The cases of disorders of the central nervous system (cerebral palsy, retardation of mental and/or physical growth, epilepsy among children) and congenital anomalies like stag horn limbs had been reported in the area (NIOH 2002). There were reports of cancer of the liver and blood, infertility and undescended testes among males, miscarriages and hormonal irregularities among women, skin disorders, asthma, psychiatric problems and suicidal tendencies in the villages situated near cashew plantations (NIOH 2002). Afflictions like congenital anomalies, mental retardation, cancer, infertility, repeated abortions, growth retardation, movement disability, epilepsy and psychiatric problems were found to be high in the affected area (Government of Kerala 2003). A higher number of people were affected with central nervous system anomalies and skeletal problems; most houses had more than one affected person and there were fewer children per family, which was unusual for the area (Government of Kerala 2003).

Most victims were children and newborn babies and their diseases were severe. They were suffering with permanent disability and disfigurement. Some of the victims had unusually thin legs and knees which were severely bruised, and large heads but a very feeble body. Children were found to be the worst affected with congenital anomalies, mental retardation, physical deformities, cerebral palsy, epilepsy, hydrocephalus, etc. Men and women were also affected with various chronic ailments, many irreversible and difficult to cure (Endosulfan Victims Relief and Rehabilitation Cell n.d; Department of Health and Family Welfare 2011).

According to the direction of the Ministry of Health and Family Welfare, Government of Kerala, the Department of Community Medicine, Government Medical College Calicut (2011) conducted a study titled “Epidemiological studies related to health in endosulfan affected areas at Kasargod district, Kerala 2010–11”. This study observed that incidents of abortion, death and birth defects among domestic animals were present significantly higher in the study area. Among human beings various diseases were found in higher prevalence, and they were: kidney and liver diseases; behavioural problems; congenital anomalies like limb deformities; congenital heart diseases; undescended testes; cleft lip; hernia; cancer; brain tumour; hormonal imbalances; genitourinary causes, etc. (Government Medical College Calicut 2011). Reproductive health problems prominent among the people were infertility, abortion, intra-uterine death, still birth, and neonatal/child death; among children, diseases like skin disease, vision problems, asthma, seizures, any congenital anomaly and congenital heart disease, cerebral palsy, undescended testes, congenital

talipes equinovares, polydactyly, Marfan syndrome, goitre, congenital adrenal hyperplasia and short stature were higher and previous surgery for birth defects was also high in children (Government Medical College Calicut 2011).

Despite considering factors such as the toxicity of endosulfan and health impacts present in the sprayed area, PCK sprayed endosulfan continuously for around 25 years in its cashew plantations situated in Kasargod: Rahman (2011, p. 32) called it “genetic terrorism”. Summarizing, the application of endosulfan from 1976 to 2000 caused high morbidity and greater prevalence of congenital malformations and malignancies in the area (Ramachandran and Mohanan 2003).

Due to these illnesses found in the area in the late 1970s, and during the 1980s–1990s, people living in those areas began protesting against aerial spraying of endosulfan and approached the state government to stop the application, but in vain. Finally in February 2001, the protestors and the victims of endosulfan acquired a stay order to stop all endosulfan applications in cashew plantations at Kasargod from the Munsif Court of Kasargod (Quijano 2002). Then on August 12, 2002, the Kerala High Court banned the sale and use of endosulfan in Kerala considering the health issues due to endosulfan in the area (Leelakumariamamma 2011; Saleem 2011). Answering towards the Public Interest Litigation (PIL) filed against pesticide endosulfan, the Supreme Court of India banned the production, storage, sale and use of the pesticide on May 3, 2011, all over India (Writ Petition (Civil) No. 213 of 2011, Supreme Court of India). In this verdict the Supreme Court pointed out that endosulfan was significantly associated with those health issues present in the area and the Court stated that it has an “obligation to protect human life, which is guaranteed under Article 21 of the Constitution of India”; thus it banned the production, storage, sale and use of endosulfan (Writ Petition (Civil) No. 213 of 2011, Supreme Court of India, p. 2).

Those health problems had attracted large-scale protest from victims and survivors of endosulfan, the attention of various organizations, including social and environmental organizations, and from the general public. The long-term collective resistance against endosulfan compelled the state government to address the issue and engaged its agencies to study the same. According to the official data, 144 persons died up to 2006 and 6,000 persons were having several health issues due to endosulfan spraying (Rahman 2015). More than 500 people died up to mid-January, 2017 and 13,000 and more persons are having serious health issues associated with endosulfan.

## DISCUSSION AND CONCLUSION

The desire for mass production, efficiency, reducing cost (E. C. Viano, personal communication, March 25, 2017), and minimizing losses, etc. are some of the driving forces of the extensive use of pesticides in agriculture. Pesticides are toxic chemicals discharged to the environment and they harm the ecosystem and subsequently living and non-living organisms. As Rachel Carson (1962, as cited in Usha 2011) illustrated in *Silent Spring*, pesticides poison the naturalness of nature and destroy the biological rhythm of nature. Lynch et al. (2013) points out that after the Second World War, chemicals and machines started to be used widely in industries with the intention to reduce the cost of production. Similar to this, as a cost-effective method, PCK engaged helicopters (instead of manual spraying using hand pumps or other means)

in aerial spraying of endosulfan in its cashew plantations situated in Kasargod. To ensure the reach of the pesticide everywhere in the vast plantations, PCK applied it from a height of more than 30 metres above the crop canopy and selected the months October to February to apply the pesticide, when the wind is high in that region. These two things, i.e. the aerial spraying of endosulfan using helicopters with the said height and the strong wind in the months chosen to spray the pesticide, made the issue of endosulfan exposure worse to a larger extent. The pesticide reached human settlements, water sources and through the water and air spread to the adjacent areas. The continuous use of endosulfan contaminated the environment and caused genetic mutations among the people with unseen health diseases.

Environmental harms and crimes negatively affect the human body and property; thus human beings are one category of victims and other victims are the environment itself and other organisms. At present, in India and many other countries, high-end pesticides, having acute toxicity many times more than endosulfan, are used for pest control. The pesticide trade generates high profits and thus pesticides are easily available and are promoted by the stakeholders. Each and every vegetable contains residues of harmful pesticides and causes serious health issues to consumers; hence identifying victims is a tough task in some cases. Christopher Williams (1996b, p. 20) points out that the outcome of victimization in environmental harms and crimes is better described as “injury” rather than “suffering”, where injury can be “any effect that results in altered structure or impaired function”. In both the Bhopal and endosulfan disasters, the victims underwent bodily injuries and at times met death due to the ill effects of these incidents.

The usage of endosulfan caused numerous health issues like neurobehavioural disorders, congenital malformations, neonatal/child death, cancers, organ anomalies, birth defects, skin problems, heart diseases, reproductive disorders, respiratory illness, etc. Various studies about the health issues confirmed that the use of endosulfan is the reason behind those diseases (see Committee for Government of Kerala 2001; Department of Health and Family Welfare 2011; Endosulfan Victims Relief and Rehabilitation Cell, n.d.; Government Medical College Calicut 2011; Government of Kerala 2003; KSCSTE 2011; NIOH 2002; Quijano 2002; Ramachandran and Mohanan 2003). Aerial spraying of endosulfan harmfully affected the environment and the living organisms in the area and also violated the rules of environmental protection and the pesticide act and rules present in the state. This study suggests that pesticide mismanagement and the associated disaster that occurred in Kasargod can be considered a crime committed against the environment since that incident damaged the ecosystem of the region and created severe health problems to humans and threatened the survival of plants and other living organisms present there.

The Supreme Court of India, in its ad-interim verdict to ban endosulfan, pointed out the reason to do so is Article 21 of the Indian Constitution which says about “the right to life”. The National Human Rights Commission ordered compensation of the endosulfan victims (INR 5 lakh or 500,000 rupees to each victim) and to provide free medical services to them. In these verdicts the criminal justice system considered the endosulfan issue in Kasargod as a human rights issue rather than a “crime”. The unprecedented and grievous impacts of endosulfan usage upon the environment and human health cannot be examined or addressed as a “crime” because there are no written laws defining pesticide mismanagement and health consequences as “crimes”.

Our criminal justice system has not yet started to recognize and address such environmental harms in its legal purview; hence no criminal proceedings have been taken in the endosulfan disaster against the perpetrators involved with it. There have been a large number of mortalities and body impairments in the form of serious health issues due to endosulfan exposure, though this cannot be considered in the light of the Indian Penal Code. In the Indian Penal Code, chapter 16 “Offences affecting human body (of offences affecting life)” contains culpable homicide, physical injuries, etc. and here in endosulfan cases similar injuries were affecting the people living in the area.

The criminal justice system stands for the safety and wellness of society and tries to protect society from the threats that challenge the wellbeing of society. Environmental crimes and harms critically challenge the wellbeing of ecosystem and living organisms including humans. In a limited manner, environmental crimes are handled in the Indian criminal justice system, like illegal logging, smuggling and trade of species including plants and animals, etc. It must be noted that from 2014 onwards, the National Crime Records Bureau, an office of the Ministry of Home Affairs, Government of India, started to include a separate chapter for environmental-related offences in its annual publication “Crime in India” (National Crime Records Bureau. n.d). The criminal justice system should have to address environmental harms and crimes, and stringent laws should be drawn up to prevent such crimes, thus rendering justice to the victims in this regard.

The 1968 Indian Insecticides Act was formed as a result of a pesticide disaster that happened in Kerala in 1958, where bags of foodstuffs, such as wheat and sugar, were stored together with bags of the organo-phosphorous insecticide “Parathion” (Folidol) in the same cabin on a ship; the insecticide leaked and contaminated the foodstuffs which further poisoned more than 1,000 people and, out of these, more than 100 people died. This incident is known as the “Kerala food poisoning case of 1958” (Aggrawal 2006). The government of India appointed a Judicial Commission to investigate this case of food poisoning due to insecticide. The Commission submitted its report and recommended that the government enact a law to regulate the manufacture, sale, storage, transport, distribution and use of insecticides including pesticides, herbicides or fungicides in the country (Anonymous 2011). There was no such law present in the country at that time. Thus the Insecticides Act, 1968 is the governmental response towards the insecticide poisoning that happened in the country. Similarly the government could enact a comprehensive legislation against pesticide mismanagement based on the endosulfan disaster in Kerala, in which pesticide mismanagement should be considered a “crime” and punishment for the perpetrators should be included, to prevent future incidents and consequent disasters. Incidents of death, body injuries and temporary or permanent disfigurement or congenital health issues and all other health problems due to pesticide mismanagement or discharge of other toxic chemicals to the environment should be considered as “offences affecting human body (of offences affecting life)” and be prosecuted accordingly. Remedial measures such as compensation, rehabilitation, free health care facilities, etc. should be available and responsibility should be defined. At that juncture the criminal justice system has to face several problems related with identifying the crime, crime prevention, identifying and punishing the offender, identifying the victim, compensating the victim, etc. Extensive and in-depth research studies should be carried out to address such issues.

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## TRANSLATED ABSTRACTS

### Sinopsis

Los pesticidas son productos químicos utilizados para matar plagas y otros organismos "rivales" que pueden causar daños a los cultivos en la agricultura. En algunos casos, el amplio uso de pesticidas puede crear efectos negativos en el medio ambiente y sus unidades, como organismos vivos y no vivos. La criminología verde considera actividades dañinas sobre el medio ambiente como crímenes o daños, aunque tales actividades sean de naturaleza legal o ilegal. El caso del desastre del endosulfán que ocurrió en Kasargod, Kerala, India puede ser considerado como un daño ambiental que afectó negativamente al medio ambiente y sus unidades, especialmente a los humanos. El pesticida endosulfan fue rociado aéreamente alrededor de 25 años en plantaciones de anacardo situadas en Kasargod y causó enfermedades graves y malformaciones extensas entre las personas que viven en la región. En este artículo, el desastre del endosulfán de Kasargod se aborda a través de una perspectiva criminológica verde de los daños ambientales.

**Palabras clave:** criminología verde; crimen ambiental; endosulfán; consecuencias para la salud.

### Résumé

Les pesticides sont des produits chimiques utilisés pour tuer les insectes nuisibles et autres organismes nuisibles qui peuvent causer des dommages aux cultures agricoles. Dans certains cas, l'utilisation massive de pesticides peut engendrer des effets négatifs sur l'environnement et ses occupants comme les organismes vivants et non vivants. La criminologie verte considère ces activités nuisibles sur l'environnement comme des crimes ou des dommages collatéraux importants, bien que ces activités soient légales ou illégales. Le cas de la catastrophe de l'endosulfan survenue à Kasargod, Kerala, en Inde, est un exemple de préjudice qui a nui à l'environnement et à ses habitants, en particulier les humains. Le pesticide endosulfan a été pulvérisé par voie aérienne pendant 25 ans dans des plantations de noix de cajou situées à Kasargod et il a provoqué de graves maladies et de graves malformations parmi les habitants de la région. Dans cet article, la catastrophe endosulfan de Kasargod est abordée à travers la perspective criminologique verte des dommages environnementaux.

**Mots-clés:** criminologie verte; criminalité environnementale; endosulfan; conséquences sur la santé.

## 摘要

農藥是用來殺死害蟲和其他可能對農作物造成損害的“對手”生物的化學物質。在某些情況下，農藥的大量使用可能對環境及其單位如生物和非生物體產生不利影響。綠色犯罪學把這種對環境有害的活動視為犯罪或危害，雖然這些活動是合法的或非合法的。印度喀拉拉邦卡薩爾戈德發生的硫丹災害案例是環境危害的一個例子，這種危害對環境及其單位，特別是人類造成不利影響。農藥硫丹在Kasargod的腰果種植園大約25年的空中噴灑，造成該地區居民嚴重的疾病和廣泛的畸形。本文通過環境危害的綠色犯罪學視角探討了卡薩爾戈德的硫丹災難。

關鍵詞：綠色犯罪學；環境犯罪；硫丹；健康後果

## ملخص

قد التي "المتنافسة" الكائنات من وغيرها الآفات قتل في تستخدم كيميائية مواد هي المبيدات المبيدات لهذه الواسع الاستخدام يؤدي قد، الحالات بعض ففسي. الزراعة بالمحاصيل ضرراً تلحق هذه إلى فينظر، الخضراء الجريمة علم أما حية وغير حية كائنات من ووحداتها البيئة على سلبية آثار إلى أو جرائم أنها على - بطبيعتها قانونية غير أو قانونية كانت سواء - بالبيئية الضارة الأنشطة من، كسرالا، كاسارغود في حدثت التي سلفان الإندو كارثة قضية اعتبار يمكن، هنا من. أضرار فمبيدات. البشر سيما ولا، ووحداتها البيئة على السلبية لتأثيرها نظراً البيئية الأضرار جملة بأمراض تسببت، كاسارغود في الواقعة الكاجو مزارع في عام 25 مدى على رشها تم التي الإندوسلفان في إندوسلفان كارثة مقارنة ستتم وبالتالي، المنطقة أهالي بين النطاق واسعة وتشوهات خطيرة البيئية للأضرار الخضراء الجريمة منظور خلال من، البحث هذا في، كاسارغود.

الصحة الآثار، الإندوسلفان البيئية، الجريمة، الخضراء الجريمة: الرئيسية الكلمات

Faisal Melangadi is a University Grants Commission (UGC) Junior Research Fellow from the Department of Criminology, University of Madras, Chennai, Tamil Nadu, India. His research specializes in green criminology focusing on environmental crimes. He completed his post-graduation in Criminology and Criminal Justice Science at Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India.

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