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Dynamic Complexity of Environmental Crime: Some Aspects of Applied Green Criminology

Prepared by Noriyoshi Takemura

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Dynamic Complexity of Environmental Crime: Some Aspects of Applied Green Criminology

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Noriyoshi Takemura

Professor of Criminology
Toin University of Yokohama, Japan

Dynamic Complexity of Environmental Crimes:
Some Aspects of Applied Green Criminology

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Introduction

Today we are facing a global crisis which includes both economic crisis and environmental/ecological crisis. In order to overcome difficulties, under the name of 'green new deal' and in accordance with sustainable developments, so-called eco-friendly economic activities and policies are urged mainly in the developed countries. As a matter of fact, these activities and policies have a duality: not only productive for some but also harmful for others: 'Janus-faced greenwash'. Moreover, these activities and policies are threatening to exert unexpected negative effects, serious environmental harms, especially in developing countries through non-linear processes: 'butterfly effects' of chaos/complexity theory (Takemura 2014b; 2007b; 2007a; 2005; 2004).

1 Worldviews of global environmental change

According to Clapp and Dauvergne, there are four contrasting worldviews of environmental change: market liberals, institutionalists, bioenviomentalists, and social greens. These are used as a framework to examine the links between the global political economy and ecological change (Clapp and Dauvergne, p.3).

The analysis of market liberals is grounded in neoclassical economics and scientific research. Market liberals believe that economic growth and high per capita incomes are essential for human welfare and the maintenance of sustainable. In terms of improving global environmental conditions, market liberals argue that economic growth (production and consumption) creates higher incomes, which in turn generate the funds and political will to improve environmental conditions (Clapp and Dauvergne, pp.4-7).

The ideas of insititutionalists are grounded in the fields of political science and international relations. Institutionalists emphasize the need for stronger global institutions and norms as well as sufficient state and local capacity to constrain and direct the global political economy. They argue that strong global institutions and cooperative norms can help enhance the capacity of all states to manage environmental

resources (Clapp and Dauvergne, pp.7-9).

Inspired by the laws of physical science, bio-environmentalists stress the biological limits of the earth to support life. The earth can support only to a certain limit, often referred to as the earth's 'carrying capacity'. Humans as a species now consume far too much of the earth's resources, such that we are near, or indeed have already overstepped, the earth's carrying capacity (Clapp and Dauvergne, pp.9-11).

Social greens, drawing primarily on radical social and economic theories, see social environmental problems as inseparable. Inequality and domination, exacerbated by economic globalization, are seen as leading to unequal access to resources as well as unequal exposure to environmental harms. In addition to feeding environmentally destructive growth and consumption, globalization is seen to breed injustice in a number of ways (Clapp and Dauvergne, pp.12-14).

2 Polluter-industrial complex in the global crisis

If the social, political and market-driven forces are left unchecked, they may propel the world into an ecological crisis of unfathomable proportions. The political-economic forces undermine efforts by legal and other regulatory agencies to curb the impact of environmental harm and exacerbate the global ecological crisis.

Faber mentions that, in the global crisis, in order to become more efficient and to compete in the world market, foreign capitals and multinational corporations operating overseas avoid paying for environmental safeguards, neglect worker health and safety standards, and exploit cheaper sources of labor. Because domestic and world export markets are becoming both more generalized and cutthroat, cost minimization strategies lay at the heart of business strategies for profit maximization. Along with labor costs, environmental protection measures are considered to be some of the most expensive and burdensome by many industries. Companies are therefore seeking to protect earnings not only by downsizing the labor force but also by cutting investments in pollution control, environmental conservation, and work health and safety (Faber, p.84).

Business is cutting production costs by spending less on pollution prevention and control, as well as on sound waste disposal methods and environmental restoration. Many sectors of industry are adopting new production processes and technologies that increase productivity but are also more polluting or destructive of the environment (Faber, p.85).

In the age of globalization, the cost of complying with various environmental laws are seen by corporate polluters as increasingly problematic. Because traditional

pollution abatement devices and cleanup technologies usually increase costs, the pollution containment and environmental conservation measures are considered to be a luxury, especially when one considers the advantage enjoyed by foreign competitors with lower labor costs and less stringent regulations (Faber, p.85).

Without prohibition and the threat of punitive actions by state regulatory agencies or the court, it is simply more profitable for corporations to pollute. Rather than spending money for pollution abatement technology, businesses avoid this expense by directly releasing pollution into the environment. So, instead of internalizing much money in costs for the installation of device to clean the air of chemical pollutants, corporations will externalize this expense onto society in the form of air pollution and other environmental health problems (Faber, p.85).

3 Liberal environmental policy and environmental injustice

He continues that not all are equally impacted by the social and ecological costs of capitalist production. In order to bolster profits and competitiveness, corporations embrace various strategies for displacing negative environmental externalities that are not only economically efficient but also politically expedient. The less political power a community of people possesses; the fewer resources (time, money, education, etc.) that people within have to defend themselves from potential threats; the lower the level of community awareness and mobilization against political ecological threats; the more likely they are to experience arduous environmental and human health problems at the hand of capital and the state. In contrast, communities with a strong economic base and high degree of control capacity over decision-making processes of local government officials and business leaders are better able to block the introduction of environmental hazards (Faber, p.86; Goldman).

It is clear that the weight of the ecological burden upon a community is dependent upon the balance of power and level of struggle between capital, the state, and social movements responding to the needs and demands of the populace (Faber, p.87).

The working class in general and the poorer people in particular, face a greater exposure effect to environmental health hazards. This first takes the form of higher rates of on the job exposure to toxics used in the production process; and secondly as greater neighborhood exposure to toxic pollutants emitted from nearby factories, toxic waste dumps, agricultural fields, transportation systems, and hazardous waste facilities. Third, unequal exposure to ecological hazards takes the form of faulty cleanup efforts implemented by the government or the waste treatment industry, such as through the

increased use of incinerators that burn these waste in the community (Faber, p.88).

As is evident from the growing toxic waste problems, pollution, and other social and environmental costs of capitalist production, the liberal regime of environmental regulation is insufficient when it comes to halting capital's displacement of environmental harm onto the working class and the poor people. In fact, many liberal policy initiatives are actually intensifying the problems they were designed to cure (Faber, p.89).

4 Transnational environmental crime and state-corporate collusion

4.1 transnational environmental crime

White analyses 'transnational environmental crime' as follows:

Contemporary discussions of environmental crime deal with issues such as the illegal transport and dumping of toxic waste, the illegal traffic in radioactive or nuclear substances, the proliferation of e-waste generated by the disposal of tens of thousand of computers and other equipment, transborder pollution that is either systematic (via location of factories) or related to accidents (e.g. chemical plant spills), the illegal trade in flora and fauna, and illegal fishing and logging. Environmental harm is by nature mobile and easily subject to transference (White 2013, p.xiii).

The systemic causal chains that underpin much environmental harm are located at the level of the global political economy, within which the transnational corporation stands as the central social force, and this is reflected in the pressing together of the local-global at a practical level. International systems of production, distribution and consumption generate, reinforce and reward diverse environmental harms and those who perpetrate them. These range from unsafe toys to reliance upon genetically modified grains, the destruction of out-of-date ships and planes through to the transportation and dumping of hazardous waste (White 2013, p.xiii).

A basic premise of green or environmental criminology is that we need to take environmental harm seriously, and that we need conceptualization of harm that go beyond conventional understanding of crime (White 2013, p.xiii).

4.2 State-corporate collusion

He looks into the state-corporate collusion. The political economic relations of global capitalism are crucial in any discussion of environmental harm insofar as how, or whether, certain human activity is regulated and facilitated is still primarily a matter of state intervention. The way in which nation states attempt to deal with environmental

concerns is contingent upon the class interests associated with political power (White 2013, p.xv).

The structure and allocation of social resources via the nation state has an impact upon how environmental issues are socially constructed. Spending on welfare, health, transportation, education and other forms of social infrastructure makes a big difference in people's lives. Recent fiscal crises (especially in European countries such as Greece, Ireland and Spain) and the global economic crisis have had the global impact of making ordinary workers extremely vulnerable economically. Under such conditions, there is even greater scope to either reduce environmental protection, or to increase environmentally destructive activity, to the extent that existing state legislation and company practices are seen to put fetters on the profit-making enterprise (White 2013, pp.xv-xxiii).

The study of the perpetrators transnational environmental crime needs to incorporate analysis of the role of the nation state, operating at many different levels (international through to local), and pursuing particular projects and protecting particular interests. Specific types of transnational environmental crime are associated with the nature and extent of state intervention (or non-intervention). Some acts of harm are allowable, and receive the approval of state authorities. Others are illegal but, without adequate state response, are in effect allowed to occur as a matter of course. The nature of state-corporate collusion varies in substantially different ways. Whether it is related to corruption or connivance, compliance or enforcement, the specific terms of arrangement between government and business do in fact matter (White 2013, pp.xxiii-xxiv).

In short, most environmental harm, and the most harmful of such, is perpetrated by firms and companies that are more likely to be seen (and to present themselves) as good corporate citizens rather than deviant organizations engaging in criminal offencie.

5 Green criminology, environmental harm, and green justice

A distinctive, critical 'green criminology' has emerged in recent years, a criminology that takes as its focus issues relating to the environment and social harm. Much of this work has been directed at exposing different instances of substantive environmental injustice and ecological injustice. It has also involved critique of the actions of nation states and transnational capital in fostering particular types of harm, and failing to adequately address or regulate harmful activity (White 2008).

According to White, environmental harm can be conceptualized in relation to legal, ecological and justice criteria. Its definition is in fact associated with quite diverse

approaches to environmental issues (White 2009, pp.1-3).

1) Conventional criminological conceptions

Over the past four decades, issues of pollution and illegal disposal of toxic waste, among others, have generated various legal and law enforcement responses, including the development of environmental protection agencies. Recent years have seen a major growth in international agreements of various kinds relating environmental issues. Conventional criminological conceptions of environmental harm tend to be based upon legal conceptions of harm as informed by laws, rules and international conventions. From this perspective, environmental crimes include such matters as:

- Illegal taking of flora and fauna;
- Pollution offences;
- Transportation of banned substances (White 2009, p.2).

2) Ecological conceptions of harm

In this instance, the main focus and interpretative lens is that of ecology. The United Nations Environmental Programme provides a classic illustration of this approach. In this framework, harm is conceived in terms of ecological well-being and holistic understandings of interrelationships between species and environments. The key issue is that of sustainability, and the division of social practices into benign and destructive, from the point of view of ecological sustainability.

An ecological perspective sees the world in terms of three areas of harm, risk or threat. These are:

- The problem of climate change;
- The problem of biodiversity;
- The problem of waste and pollution.

Ecological understandings of harm view these matters in essentially transboundary terms: there is worldwide transference of harms. The imperative is ecological, not legal, and the goal is human survival (White 2009, p.2).

3) Green criminological conceptions

Environmental harm is best seen in terms of justice, based upon notions of human, ecological and animal rights, and egalitarian concerns. The key issue is weighing up of different kinds of harm and violation of rights within a broad eco-justice framework, and stretching the boundaries of conventional criminology to include other kinds of harm than those already deemed illegal (White 2009, p.2).

Within green criminology, three broad approaches to justice have been identified. They are:

- Environment rights and environmental justice;
- Ecological citizenship and ecological justice;
- Animal rights and species justice.

The biggest threat to environmental rights, ecological justice and non-human animal well-being are system-level structures and pressures that commodify all aspects of social existence, that are based upon the exploitation of humans, non-human animals and natural resources, and that privilege the powerful minority over the interests of the vast majority. Those who determine and shape the law are very often those whose activities need to be criminalized for the sake of planetary well-being. Environmental harm is thus intrinsically contestable, both at the level of definition, and in terms of visions of what is required for desired social and ecological change (White 2009, pp.2).

6 Treadmill of crime: political economy and green criminology

6.1 Crimes of ecological withdrawals and ecological additions

Stretesky, Long and Lynch, organizing around crimes of ecological withdrawals and ecological additions, return political economy to green criminology and examine how the expansion of capitalism shapes environmental law, crime and justice.

They get down to bedrock of capitalism. According to them, capital does not tally the costs of the damage it produces as part of any of its ledgers of production, nor does it possess the long-run vision or the ability to step outside of its present-oriented self-interest that drives profit-making to consider the needs of future generations. Capital is a hedonistic, self-interested system of production and consumption based on expansion, and at every step throughout its life course it has offended against nature. The ideology of nature produced by capitalism is based on a deconstruction of nature into isolated and abstract, discrete entities. This deconstruction of nature has paved the way for large-scale environmental destruction to facilitate the expansion of the capitalist system of production in ways that are consistent with accumulative tendencies (Stretesky et al., pp.145, 154).

Green crimes are, they argue, public more than personal troubles, patterned by and extensively connected to the economy and the ecology. Focusing on ‘treadmill of production’ theory developed by Allan Schnaiberg (Schnaiberg), and using it as a framework for organizing green criminology, green crimes can be boiled down to crimes that are a result of ecological withdrawals and those that are a results of

ecological additions. Green crime should be organized in this fashion because withdrawals and additions present a language that focuses on the relationship between the economy and ecology (Stretesky et al., pp146-147).

They proceed to the political economy of environment. The treadmill of production approach is heavily rooted in a political economy of the environment. The study of political economy has implications for the way that natural production, ecological disorganization, and environmental destruction are treated by the state. Acts central to production tend to take legal precedent over those central to ecology. When the state defines some acts as environmental crime, it leaves out a great deal of significant ecological destruction that occurs through routine economic activity within a capitalist system. A definition of green crime is presented as an act or acts that cause or have the potential to cause significant harm to ecological systems for the purposes of increasing or supporting economic production (Stretesky et al., p.147).

6.2 Political economy of green crime

Stretesky, Long and Lynch demonstrate that production is central to the economy, and economic production is prioritized over ecological production. Corporate actors have an incentive to constantly increase production in a capitalist system, and it is often the case that the harm caused through production is hidden by ideological baggage and bias. Corporations engage in acts that damage ecological systems, despite corporate and state claims that corporations have become ‘green’. Criminologists should study how corporations are able to work within the current capitalist system to manipulate laws that favor their economic interests over the interests of the ecology. Green criminologists can point out those contradictions between the economy and the ecology, in order to bring attention to the issue of environmental harm (Stretesky et al., pp.148-149).

Laws that govern ecological additions and withdrawals are, they continue, linked to trends in corporate and state behavior. The relationship between the state and corporations is readily connected to the notion of state-corporate crime. More specifically, ideas about state-facilitated crime are highly compatible with the notion of green crime and treadmill of production because they can be applied to the study of governmental regulatory systems and the failure of laws to address ecological harm. Connections that are identified in the state-corporate crime literature are central in establishing a political economy of green crime. This demonstration of how state-facilitated actions on the part of corporations are a form of crime, reframes ecological disorganization in terms that reveal the source and extent of the damage and

harm that is associated with the continual expansion of production (Stretesky et al., p.149).

7 Complexity and struggle for social justice

The utility of a definition of environmental crime will be the degree to which it elicits new types of existential territories, and makes possible new modes of envisioning the human/earth nexus. The task of the critic will be to draw attention to the possible by showing the contingent dimensions of the actual. The challenge is one of nurturing assemblages willing to throw the transformative weight of the acategorical behind socio-ecological struggle (Halsey 2004).

In this connection, constitutive criminology defines crime from the point of view of harm as the power to deny others their ability to make a difference. Harm is the investment of energy in injury-producing, socially constructed relations of power based on inequalities constructed around differences. Harms are actions and processes that deny or prevent us from being or becoming fully human. To be human means to make a difference in/to the world, to act on it, to interact with others, and together to transform the environment and ourselves (Arrigo and Milovanovic 2009).

Because the causality of environmental crime/harm is too complicated to be ascribed to simple cause-effect relations or a single or some factors, it is necessary to introduce a nonlinear way of thinking in order to recognize this problem as a whole. If complicated relations are simplified to one linear relation, this means that other important relations and different voices are oppressed and excluded. In so doing, injustice based on a particular self-righteous interest is justified (Capeheart and Milovanovic 2007).

In complex natural and social systems, a concept of ‘green justice’ plays a vital role in order to realize social justice. Struggle for green justice are inevitably multicultural, highly diverse, and increasingly global in their methods, interests, and goals. Green justice suggests a development of more spontaneous notions of justice in context, and call for non-linear justice systems. It is an emergent arising in far-from-equilibrium conditions. There is recognition of flux, uncertainty, change, becoming, multiplicity, indeterminacy, instabilities. These emerging principles of justice are the bases of generating political agendas for social change and for social justice (Capeheart and Milovanovic 2007).

Conclusions

My recent research on global environmental/ecological crisis based on a complexity green criminology have found that, although advertizing their eco-friendly postures, greenwashes, transnational/multinational corporations have caused serious environmental/ecological harms through their globally expanded activities: deforestation, air pollution, water and soil contamination, hazardous waste trafficking and disposal and so on (Takemura 2010a; 2010b; 2012b; 2014c). Also my research on global environmental/ecological crisis based on a complexity green victimology have cleared that, although fraudulent discourses/logics like pervasive harms/destructions and simultaneous victims-offenders have been prevailed, environmental/ecological harms are in fact unequally distributed between rich societies and poor societies, between developed countries and developing countries. In other words, there is a huge disparity of environmental/ecological harms: water crisis, biodiversity crisis and loss, nuclear power plants problems and so on (Takemura 2010d; 2011; 2008; 2009a; 2012a; 2013a).

In order to overcome environmental/ecological economic crimes, based on a new concept "complexity green social justice" which consists of complexity justice, green justice and social justice, a symbiosis between human beings and nature should be pursued (Takemura 2014a; 2009b; 2009c; 2010c; 2013b).

Note:

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Is the Minamata Convention on Mercury feasible?
Can the global mercury agreement lift health threats from live of millions worldwide?

1 Introduction

Mercury is a pollutant of global, regional, and local concern. Humans have mined mercury for millennia, and this silver-colored element is still commonly used in industrial processes and household products. An assessment by the United Nations Environment Programme (UNEP) estimated that 1,960 tonnes of mercury were released into the atmosphere from anthropogenic sources in 2010 (see Figures 1 and 2). At least another 1,000 tonnes were released by human activities into water (UNEP 2013a). (H. Selin, p.1)

Mercury (Hg) is released from the Earth's crust through natural processes including volcanic eruptions and the weathering of rocks as well as human activities. During mining, industrial manufacturing, and the disposal of goods, mercury is released into the environment. The burning of coal also emits considerable amounts of mercury into the atmosphere. Mercury poses significant local contamination problems, but in its elemental form also travels long distances through the atmosphere before oxidizing and depositing in ecosystems. In aquatic systems, mercury from local and distant sources can convert by biological activity in anaerobic environments into methylmercury, a serious neurotoxin (Selin 2009). High-dose exposure can lead to significant neurological damage and fatalities. Low-dose exposure has been linked to developmental delays and neurological damage affecting brain and muscle capacity, especially in small children (AMAP 2011). (H. Selin, p.2)

The Minamata Convention on Mercury, adopted in October 2013 in the Japanese city where a deadly mercury poisoning incident was recognized in the 1950s, sets out to "protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds" (Article 1). This new convention is a significant international legal and political milestone, as methylmercury, a potent neurotoxin, poses serious environmental and health risks to both children and adults. (H. Selin, p.1)

In this research, first, multiplicities of mercury issues are explained and analyzed, second, Minamata Convention on Mercury is explained and critically reviewed, third, mercury as global pollutant and its control are examined.

2 Multiplicities of Mercury Issues

2.1 Health and environmental hazards of mercury

Mercury, whose emissions will be controlled under the new Minamata Treaty, presents a major health risk worldwide. It is released to the atmosphere from industrial activities such as metal and cement production, manufacture of vinyl chloride monomer, municipal waste incineration, fossil fuel combustion and mining. Some 10-15 million miners around the world are exposed to mercury (UNEP 2013). Mercury is used in a variety of products, including some computer monitors, some batteries, automobile switches, thermostats, medical devices and compact fluorescent light bulbs. When these products are disposed of or broken, the mercury can be released into the environment. Total mercury emissions were estimated at 1 960 tonnes in 2010 (UNEP 2013). (UNEP YB, p.42)

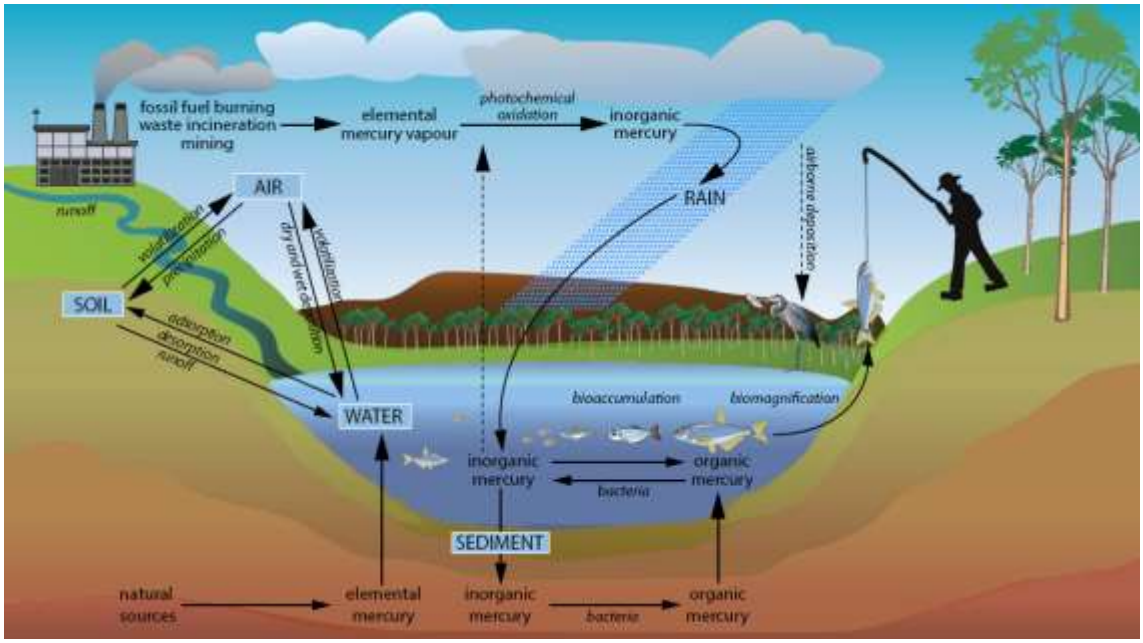

Figure 1: Health and environmental hazards of metals
(Source: UNEP 2013d, Fig.3 p.42)

Mercury contamination affects people along several environmental pathways. Highly toxic methylmercury is formed in wet soil, sediments and water, where it bioaccumulates and biomagnifies. Fish consumption is a main route of human exposure. Infants, children and women of child-bearing age are particularly vulnerable to adverse health effects, which include permanent damage to the nervous system. Mercury can be

transferred from mothers to unborn children. (UNEP YB, p.42)

2.2 Minamata disease and its problems

Minamata disease, which can induce lethal or severely debilitating mental and physical effects, was caused by methylmercury-contaminated effluent released into Minamata Bay by Chisso, Japan's largest chemical manufacturer. It resulted in widespread suffering among those who unknowingly ate the contaminated fish. Minamata disease is documented in three phases. (EEA, p.15)

The disease first came to prominence in the 1950s. It was officially identified in 1956 and attributed to factory effluent but the government took no action to stop contamination or prohibit fish consumption. Chisso knew it was discharging methylmercury and could have known that it was the likely active factor but it chose not to collaborate and actively hindered research. The government concurred, prioritising industrial growth over public health. In 1968 Chisso stopped using the process that caused methylmercury pollution and the Japanese government then conceded that methylmercury was the etiologic agent of Minamata disease. (EEA, p.15)

The second phase addresses the discovery that methylmercury is transferred across the placenta to affect the development of unborn children, resulting in serious mental and physical problems in later life. Experts missed this at first because of a medical consensus that such transfer across the placenta was impossible. (EEA, p.15)

The third phase focuses on the battle for compensation. Initially, Chisso gave token 'sympathy money' under very limited criteria. In 1971 the Japanese government adopted a more generous approach but after claims and costs soared a more restrictive definition was introduced in 1977, justified by controversial 'expert opinions'. Legal victories for the victims subsequently made the government's position untenable and a political solution was reached in 1995–1996. In 2003, the 'expert opinions' were shown to be flawed and the Supreme Court declared the definition invalid in 2004. (EEA, p.15)

In September 2011 there were 2 273 officially recognised patients. Still, the continuing failure to investigate which areas and communities were affected means that the financial settlement's geographic and temporal scope is still not properly determined. Alongside deep-seated issues with respect to transparency in decision-making and information sharing, this indicates that Japan still faces a fundamental democratic deficit in its handling of manmade disasters. (EEA, p.15)

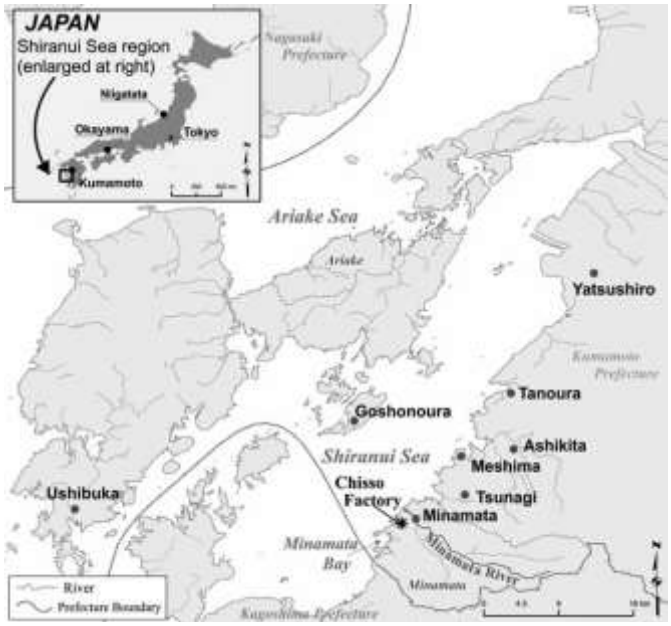

Figure 2: Location of Minamata City
(Source: Ministry of Environment, p.)

3 The Minamata Convention on Mercury

3.1 Contents of Minamata Convention

Key provisions of the Minamata Convention can be categorized into five sets of issues: a) supply and trade; b) products and processes; c) emissions and releases; d) artisanal and small-scale gold miming (ASGM); and e) resources and compliance. (H.Selin, p.1, 3)

a) Supply and trade

 New mercury mining is prohibited but existing extraction may continue for up to 15 more years after the treaty become legally binding for a party.

 Mined mercury may only be used in permitted products and manufacturing processes, and should be disposed of in ways that do not lead to continued re-use.

 Excess mercury from the decommissioning of chlor-alkali facilities cannot be re-used and parties should identify other major secondary sources and stockpiles of mercury.

 Mercury trades between parties can only take place after the importing party provides written prior informed consent.

 Parties can only export to non-parties that have measures in place to protect human health and the environment and follow treaty provisions on allowed uses, storage and disposal.

 Parties should only allow imports from non-parties proving guarantees that mercury

comes from a source allowed under the treaty.

b) Products and processes

 Parties should cease manufacturing, import, and export of nine mercury-added product categories by 2020, but can ask for five plus five years of exemptions.

 Dental amalgam is subject to restrictions with a list of measures for reduced use that parties can elect to take.

 Parties should phase-out mercury use in two kinds of industrial processes by 2018 and 2025 respectively, but can ask for five plus five years of exemptions.

 Parties should reduce mercury use in three kinds of industrial processes where each process has its own requirements.

 Parties should discourage the manufacture and commercial distribution of new mercury-added products and the development of new facilities that use mercury in manufacturing processes.

c) Emissions and releases

 Parties should apply BATs and BEPs to five categories of new point sources to control and where feasible reduce emissions no later than five years after the treaty enters into force.

 Parties should control and where feasible reduce emissions from five categories of existing point sources through emissions limit values, BAT, BEP, or other alternative measures including co-benefits strategies no later than 10 years after the treaty becomes legally binding.

 Parties should control and where feasible reduce mercury releases to land and water from point sources through BAT and BEP or alternative measures including multi-pollutant strategies.

d) Artisanal and small-scale goal miming

 Parties should reduce and where feasible eliminate the use of mercury in, and the releases to the environment of mercury from ASGM mining and processing.

 Parties with “more than insignificant” ASGM and processing shall develop a national action plan outlining national objectives, reduction targets, and actions to eliminate whole ore amalgamation and open burning or amalgam as well as all burning of amalgam in residential areas.

e) Resources and compliance

 The GEF Trust Fund shall provide financial resources to support treaty implementation, and additional financial resources for a specific international program should be provided on a voluntary basis.

 Parties shall cooperate to provide within their respective capabilities timely and

appropriate capacity-building and technical assistance to developing country parties.
 A 15-member committee operating as a COP subsidiary body should promote implementation and address compliance issues.
 The COPs should no later than six years after entry into force begin periodical effectiveness evaluations of the convention.

3.2 Review of Minamata Convention

The convention covers sources collectively responsible for 96 percent of atmospheric emissions included in the UNEP assessment, and its mandates will affect countries, firms, and consumers all over the world (see Table 1)1. However, initial controls will only have a limited impact on curbing global emissions and releases (Selin 2013). In light of the lack of explicit numerical reduction targets to meet its stated environmental and human health goal, the convention mandates must be strengthened and engender support from a broad set of public, private, and civil society actors. (H.Selin, p.1)

The Minamata Convention is part of a cluster of agreements on hazardous substances and wastes, together with the Rotterdam, Basel, and Stockholm Conventions. These earlier treaties were off to similarly modest beginnings as the Minamata Convention, but their respective COPs have strengthened mandates over time. This demonstrates that it is possible to make valuable progress towards better environmental and human health protection during treaty implementation (Selin 2010). (H.Selin, p.6)

The Minamata Convention is initially more legally and politically important than environmentally significant; it creates a platform for continued cooperation, but many initial mandates are weak and do not take effect for another five, ten, or fifteen years. To achieve the goal of protecting the environment and human health from mercury emissions and releases, collaborative actions must be coordinated across global, regional, national, and local governance scales (Selin and Selin 2006; Selin 2011). (H.Selin, p.6)

3.3 The Political economy of a global ban on mercury-added products: positive versus negative approaches

There are two regulatory options commonly used in multilateral environmental agreements. In case of the recent global efforts to gradually phase-out the use of mercury-added products, in the first approach no mercury-added products would be allowed unless they are listed in an annex (the negative list), while in the second approach all mercury-added products would be allowed unless they are listed in an

annex (the positive list). In both cases countries may have time to make the transition away from these products through the use of exemptions. (Soederholm, p.287)

The negative list approach could facilitate a more cost-effective phase-out of mercury, in part since in this case an individual country seeking exemption would bear the burden of identifying the need for the exemption. This requires, though, the use of long-term compliance periods for selected products groups. With the positive list approach, the one country adopted in the Minamata Convention on mercury, it may be more difficult to induce mercury users to reveal their true costs of substituting to other products. (Soederholm, p.287)

3.4 Bringing the Convention Home to Minamata

In October 2013 a new international convention to control mercury emissions was open for signing in Japan. Named the Minamata Convention on Mercury, the agreement is a response to the realization that mercury pollution is a global problem that no one country can solve alone. The convention was four years in the making, with more than 130 nations agreeing by consensus to a final text in January 2013. It includes both compulsory and voluntary measures to control mercury emissions from various sources, to phase the element out of certain products and industrial processes, to restrict its trade, and to eliminate mining of it. (Kessler, p.A308)

The Japanese government pushed for the convention to be named after the Minamata tragedy.28 Even so, nearly 60 years after that incident came to light, victims' groups say the Chisso Corporation has not been held sufficiently accountable, and the pollution has not been properly cleaned up. And they say the Japanese government has neither fully assessed the damage to human health and the environment nor adequately compensated victims. (Kessler, p.A308)

The government officially recognizes fewer than 3,000 patients from the Minamata and Niigata incidents, more than half of whom are now dead. Those patients have received some compensation and medical expense payments, while around 10,000 others have received more modest compensation for having "applicable conditions."29 Yet more than 65,000 people have reportedly applied for compensation and medical expenses under a new program. (Kessler, p.A308)

During the negotiations, several Minamata disease victims' groups and other organizations argued that if the convention was to bear the Minamata name, the Japanese government must resolve these issues at home, and the convention should be strong enough to prevent similar tragedies. (Kessler, p.A308)

4 Mercury as a Global Pollutant and its Control

4.1 Science and strategies to reduce mercury risks

Policy activity to date has focused on the mercury problem at a single level of spatial scale, and on near-term timescales. Efforts at the local scale have focused on monitoring levels in fish and addressing local contamination issues; nationalscale assessments have addressed emissions from particular sources; and global-scale reports have integrated long-range transport of emissions and commercial trade concerns. However, aspects of the mercury issue that cross the political scale (such as interactions between different forms of mercury) as well as contamination problems with long timescales are at present beyond the reach of current policies. It is argued that these unaddressed aspects of the mercury problem may be more effectively addressed by (1) expanded cross-scale policy coordination on mitigation actions and (2) better incorporating adaptation into policy decision-making to minimize impacts. (N.E.Selin, p.2389)

Policy makers at multiple levels of scale have attempted to address mercury due to concern about human and environmental exposures. Policy activities to date have been conducted at levels of spatial scale corresponding to typical governmental organization (local, national/regional, international). Policy actions to reduce mercury emissions and manage risks associated with mercury exposure are proceeding at multiple political scales simultaneously, each covering a different aspect of a connected, regional-to-global scientific issue. In addition, the temporal scales of the mercury problem range from days (local transport and deposition of industrial emissions), months (intercontinental transport), years (short-term ecosystem dynamics and fish accumulation), decades (longer-term ecosystem dynamics, fish dietary patterns, consumption patterns), to centuries and longer (global biogeochemical cycling). These temporal scales also match imperfectly with the timescales of policy. More effective governance of mercury risks would require better taking into account the multiscale characteristics of the mercury problem. (N.E.Selin, pp.2396-2397)

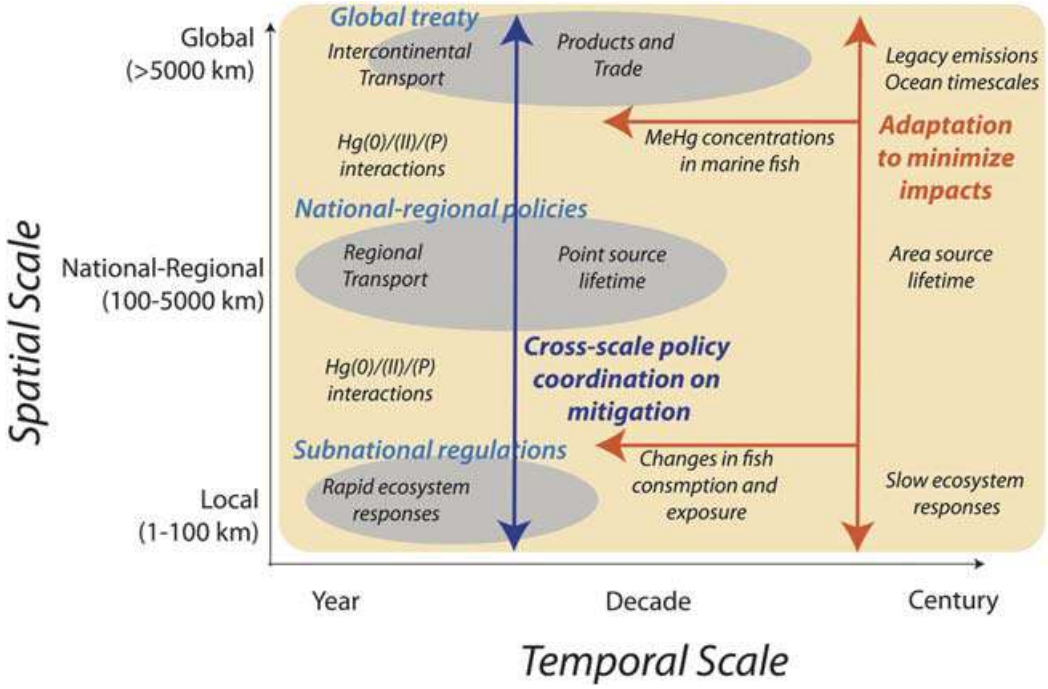

Figure 3: Temporal and Spatial Scale (Source: Selin, N.E., 2011, p.2397, Fig2)

Two types of solutions emerge for the spatial and temporal challenges associated with the mercury problem. These are illustrated in Fig. 2 by the red and blue arrows. First, to address the elements of the mercury issue that fall between the spatial scales of policy-making, better coordination among political levels is necessary. Second, to address environmental and earth systems problems that occur on timescales longer than the usual political actions, a two-pronged approach is necessary, that combines forwardlooking mitigation strategies with adaptation. (N.E.Selin, pp.2397-2398)

Making effective policy across scales on environmental issues is an ongoing challenge that is only beginning to be addressed by both the policy and research communities. From a scientific perspective, regulatory developments provide a critical demandside push for further relevant investigations. Despite decades of policy action and research, mercury remains on political agendas as an environmental problem; it is unlikely to be solved without attention by both scientists and regulators to these cross-scale interactions and connections. This analysis suggests that the mercury regime is best conceptualized as a science-policy system with multiple driving forces and interactions at multiple scales. Cross-scale policy coordination and adaptation to minimize impacts are two strategies that could successfully create solutions not only for mercury, but also may apply to other environmental issues that cross spatial and temporal scales. (N.E.Selin, p.2398)

4.2 Complexity, multiple effects and thresholds

Increasing scientific knowledge has shown that the causal links between stressors and harm are more complex than was previously thought and this has practical consequences for minimising harm. Much of the harm is caused by several co-causal factors acting either independently or together. For example, the reduction of intelligence in children can be linked to lead in petrol, mercury and polychlorinated biphenyls (PCBs) as well as to socio-economic factors; bee colony collapse can be linked to viruses, climate change and nicotinoid pesticides; and climate change itself is caused by many complex and inter-linked chemical and physical processes. (EEA, p.39)

In some cases, such as foetal or fish exposures, it is the timing of the exposure to a stressor that causes the harm, not necessarily the amount; the harm may also be caused or exacerbated by other stressors acting in a particular timed sequence. There are also varying susceptibilities to the same stressors in different people, species and ecosystems, depending on pre-existing stress levels, genetics and epigenetics. This variation can lead to differences in thresholds or tipping point exposures, above which harm becomes apparent in some exposed groups or ecosystems but not others. (EEA, p.39)

Our increased knowledge of complex biological and ecological systems has also revealed that certain harmful substances, such as polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichlorethane (DDT) can move around the world via a range of biogeochemical and physical processes and then accumulate in organisms and ecosystems many thousands of kilometres away. (EEA, p.39)

The practical implications of these observations are threefold. First, it is very difficult to establish very strong evidence that a single substance or stressor 'causes' harm to justify timely actions to avoid harm; in many cases only reasonable evidence of co-causality will be available. Second, a lack of consistency between research results is not a strong reason for dismissing possible causal links: inconsistency is to be expected from complexity. Third, while reducing harmful exposure to one co-causal factor may not necessarily lead to a large reduction in the overall harm caused by many other factors, in some cases the removal of just one link in the chain of multi-causality could reduce much harm. (EEA, pp.39-40)

A more holistic and multi-disciplinary systems science is needed to analyse and manage the causal complexity of the systems in which we live. (EEA, p.40)

As experiences from mercury, nuclear accidents, leaded petrol, mobile phones, BPA, and bees show, there can be a significant divergence in the evaluations of the same, or very similar, scientific evidence by different risk assessment committees. In such

instances, differences in the choice of paradigm, assumptions, criteria for accepting evidence, weights placed on different types of evidence, and how uncertainties were handled, all need to be explained. Risk assessors and decision makers also need to be aware that complexity and uncertainty have sometimes been misused to shift the focus away from precautionary actions by 'manufacturing doubt' and by waiting for 'sound science' approaches that were originally developed by the tobacco industry to delay action. (EEA, p.41)

5 Conclusions

As mercury pollution continues to pose environmental and health risks all over the world, it is essential that concerted abatement measures are carried out in connection with the implementation of the Minamata Convention. Action — or inaction — that occurs today will have a long-lasting effect on levels of mercury exposure for generations to come. (H.Selin, p.7)

One thing that has become clearer over the past decade is that certain chemical substances are highly stable in nature and can have long-lasting and wide ranging effects before being broken down into a harmless form. The risk of a stable compound is that it can be bio-accumulated in fatty tissues at concentrations many times higher than in the surrounding environment. Predators, such as polar bears, fish and seals, are known to bio-magnify certain chemicals in even higher concentrations with devastating consequences for both humans and ecosystems. So exposure to toxic chemicals and certain foodstuffs are at risk of causing harm, especially to vulnerable groups such as foetuses in the womb or during childhood when the endocrine system is being actively built. Even with small dose exposures, the consequences can in some instances be devastating with problems ranging from cancer, serious impacts on human development, chronic diseases and learning disabilities. Here the power to act could be more properly set by well-informed individuals and communities. (EEA, p.7)

The relationship between knowledge and power lies at the heart of many researches. The implicit links between the sources of scientific knowledge about pollutants, changes in the environment and new technologies, and strong vested interests, both economic and paradigmatic, are exposed. Some researchers also explore in greater depth, the short-sightedness of regulatory science and its role in the identification, evaluation and governance of natural resources, physical and chemical hazards. By creating a better understanding of these normally invisible aspects, it is hoped that communities and people become more effective stakeholders and participants in the

governance of innovation and economic activities in relation to the associated risks to humans and the planet. (EEA, p.7)

Note:

1) This paper is based on two papers. The one is titled "Prevention and Reduction of Mercury Pollution in Global Context: Why Minamata? Past, Present and Future" and presented at the 13th Annual Conference of the European Society of Criminology, 4-7 September, 2013, Budapest, Hungary. The other is titled "Is the Minamata Convention on Mercury feasible? Can the global mercury agreement lift health threats from live of millions worldwide?" and presented at the 69th Annual Meeting of the American Society of Criminology, November 20-23, 2013, Atlanta, Georgia, U.S.A.

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Water Crisis, Water Justice and Water Democracy:
One Aspect of Struggle for 'Green Social Justice' as
'Applied Complexity Green Criminology'

1 Introduction

We are facing a global water crisis. Lots of people around the world are in a critical situation of their lives. According to a report by the United Nations, some 1.2 billion persons worldwide do not have access to safe drinking water. Their fundamental rights to live are exposed to the menace of this crisis and its mismanagement, and water privatization. Diverse environmental crimes threaten to intensify water crisis. Moreover, global warming and population explosion have made the problem of lack of water more and more serious. As the water crisis is unequally distributed and burdened among persons, in general, poor people are facing their crises of existence. In recent years there happen lots of conflicts over water all over the world.

In this paper, as one aspect of 'applied complexity green criminology', and struggling for 'green social justice', problems around water crisis are anatomized and a new direction, 'water justice and water democracy', is suggested.

2 Complexity System of Water

2.1 Climate Change and Water

IPCC Technical Paper VI (IPCCTP VI) explains that the importance of freshwater to our life support system is widely recognized in the international context. Freshwater is indispensable for all forms of life and is needed in almost all human activities. Climate, freshwater, biophysical and socioeconomic systems are interconnected in complex ways, so a change in any one of these induces a change in another. Anthoropogenic climate change adds a major pressure to nations that are already confronting the issue of sustainable freshwater use. The challenges related to freshwater are: having too much water, having too little water, and having too much pollution. Each of these problems may be exacerbated by climate change. Freshwater-related issues play a pivotal role among the key regional and sectoral vulnerabilities. Therefore, the relationship between climate change and freshwater resources is of primary concern

and interest (Bates et al., p.7).

IPCCTP VI continues that so far, water resource issues have not been adequately addressed in climate change analyses and climate policy formulations. Likewise, in most cases, climate change problems have not been adequately dealt with in water resource analyses, management and policy formulation. According to many experts, water and its availability and quality will be the main pressure on, and issues for, societies and the environment under climate change; hence it is necessary to improve our understanding of the problems involved (Bates et al., p.7).

2.2 Socio-economic/Environmental Conditions and Water

IPCC Technical Paper VI analyzes the relationship between socio-economic/environmental conditions and water. It says that the relationship between climate change and freshwater do not exist in isolation, but in the context of, and interacting with, socio-economic and environmental conditions. Many non-climate drivers affect freshwater resources at all scales, including the global scale. Water resources, both in terms of quantity and quality, are critically influenced by human activity, including agriculture and land-use change, construction and management of reservoirs, pollutant emissions, and water and wastewater treatment. Water use is linked primarily to changes in population, food consumption, economic policy (including water pricing), technology, lifestyle and society's views about the value of freshwater ecosystems. In order to assess the relationship between climate change and freshwater, it is necessary to consider how freshwater has been, and will be, affected by changes in these non-climatic drivers (Bates et al., p.8).

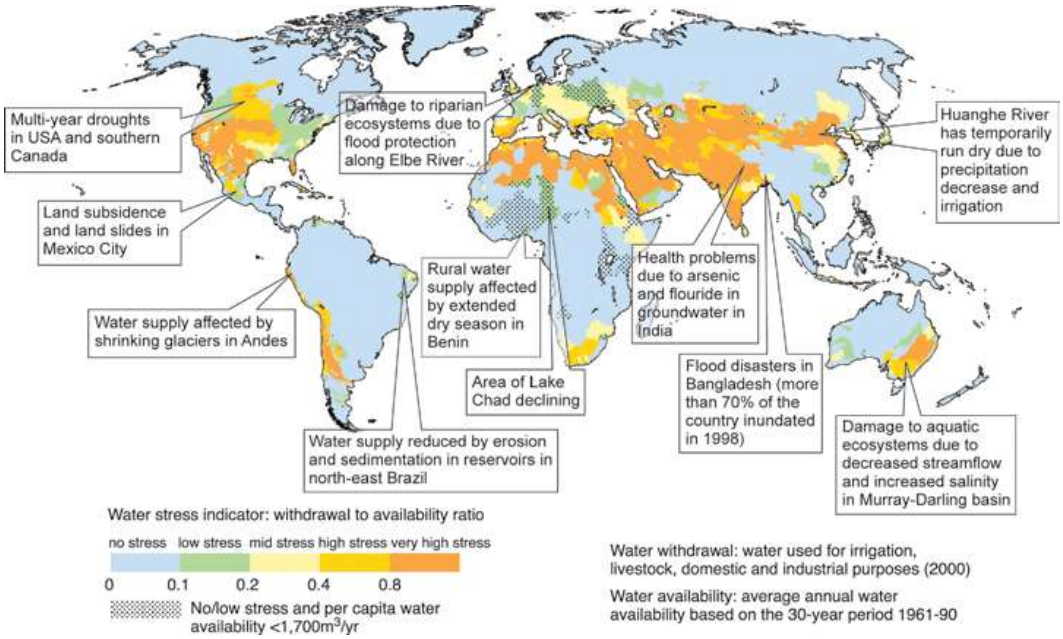
IPCCTP VI continues that in global-scale assessments, basins are defined as being water-stressed if they have either a per capita water availability below 1,000 cubic meter per year (based on long-term average runoff) or a ratio of withdrawals to long-term average annual runoff above 0.4. Such water-stressed basins are located in northern Africa, the Mediterranean region, the Middle East, the Near East, southern Asia, northern China, Australia, the USA, Mexico, north-eastern Brazil and the west coast of South America. The estimates for the population living in such water-stressed basins range between 1.4 billion and 2.1 billion (Bates et al., p.8).

Then IPCCTP VI says that in water-stressed areas, people and ecosystems are particularly vulnerable to decreasing and more variable precipitation due to climate change. In most countries, except for a few industrialized nations, water use has increased over recent decades, due to population and economic growth, changes in

lifestyle, and expanded water supply systems, with irrigation water use being by far the most important cause. Irrigation accounts for about 70% of total water withdrawals worldwide and for more than 90% of consumptive water use (i.e. the water volume that is not available for reuse downstream). Irrigation generates about 40% of total agricultural output. The area of global irrigated land has increased approximately linearly since 1960, at a rate of roughly 2% per annum, from 140 million ha in 1961/63 to 270 million ha in 1997/99, representing about 18% of today's total cultivated land (Bates et al., pp.8-9).

Moreover, IPCCTP VI explains that although the rates of regional population change differ widely from the global average, the rate of global population increase is already declining. Global water use is probably increasing due to economic growth in developing countries, but there are no reliable data with respect to the rate of increase. The quality of surface water and groundwater has generally declined in recent decades due principally to growth in agricultural and industrial activities. To counter this problem, many countries (e.g., in the European Union and Canada) have established or enforced effluent water standards and have rehabilitated wastewater treatment facilities (Bates et al., p.9).

Figure 1: Examples of current vulnerabilities of freshwater resources and their management (Bates et al. p.9 Figure 1.1)



3 Global Water Crises – General Remarks

3.1 World Water Assessments

The UN World Water Development Report (UNWWDR) sets the scene of world's water crisis. At the beginning of the twenty-first century, the Earth, with its diverse and abundant life forms, including over six billion humans, is facing a serious water crisis. All the signs suggest that it is getting worse and will continue to do so, unless corrective action is taken. This crisis is one of water governance, essentially caused by the ways in which we mismanage water. But the real tragedy is the effect it has on the everyday lives of poor people, who are blighted by the burden of water-related disease, living in degraded and often dangerous environments, struggling to get an education for their children and to earn a living, and to get enough to eat. The crisis is experienced also by the natural environment, which is groaning under the mountain of wastes dumped onto it daily, and from overuse and misuse, with seemingly little care for the future consequences and future generations. In truth it is attitude and behavior problems that lie at the heart of the crisis. We know most (but not all) of what the problems are and a good deal about where they are. We have knowledge and expertise to begin to tackle them. We have developed excellent concepts, such as equity and sustainability. Yet inertia at leadership level, and a world population not fully aware of the scale of the problem (and in many cases not sufficiently empowered to do much about it) means we fail to take the needed timely corrective actions and put the concepts to work (UNWWAP 2003, p4).

UNWWDR continues that, for humanity, the poverty of a large percentage of the world's population is both a symptom and a cause of the water crisis. Giving the poor better access to better managed water can make a big contribution to poverty eradication, as *The World Water Development Report* (WWDR) will show. Such better management will enable us to deal with the growing per capita scarcity of water in many parts of the developing world. Solving the water crisis in its many aspects is but one of the several challenges facing humankind as we confront life in this third millennium and it has to be seen in that context. We have to fit the water crisis into an overall scenario of problem-solving and conflict resolution. Yet of all the social and natural resource crises we humans face, the water crisis is the one that lies at the heart of our survival and that of our planet Earth (UNWWAP 2003, p4).

3.2 Natural Water Cycle

UNWWDR looks at the natural water cycle, and explains that , although water is the most widely occurring substance on earth, only 2.53 percent is freshwater while the remainder is salt water. Some two thirds of this freshwater is locked up in glaciers and permanent snow cover. The available freshwater is distributed regionally as shown in table 1 (UNWWAP 2003, p.8).

Table 1: Water availability versus population (made from UNWWAP 2003, p.9, Figure 1)

region	water (%)	population (%)
Africa	11	13
Asia	36	60
Australia and Oceania	5	1
Europe	8	13
North and Central America	15	8
South America	26	6

UNWWDR continues that, in addition to the accessible freshwater in lakes, rivers and aquifers, man-made storage in reservoirs adds a further 8,000 cubic kilometres (km3). Water resources are renewable (except some groundwater), with huge differences in availability in different parts of the world and wide variations in seasonal and annual precipitation in many places. Precipitation is the main source of water for all human uses and for ecosystems. This precipitation is taken up by plants and soils, evaporates into the atmosphere via evapotranspiration, and runs off to the sea via rivers, and to lakes and wetlands. The water of evapotranspiration supports forests, rainfed cultivated and grazing lands, and ecosystems. We withdraw 8 percent of the total annual renewable freshwater, and appropriate 26 percent of annual evapotranspiration and 54 percent of accessible runoff. Humankind's control of runoff is now global and we are significant players in the hydrological cycle. Per capita use is increasing (with better lifestyles) and population is growing. Thus the percentage of appropriated water is increasing. Together with spatial and temporal variations in available water, the consequence is that water for all our uses is becoming scarce and leading to a water crisis (UNWWAP 2003, pp.8-9).

UNWWDR analyzes that freshwater resources are further reduced by pollution.

Some 2 million tons of waste per day are disposed of within receiving waters, including industrial wastes and chemicals, human waste and agricultural wastes (fertilizers, pesticides and pesticide residues). Although reliable data on the extent and severity of pollution is incomplete, one estimate of global wastewater production is about 1,500 km3. Assuming that 1 litre of wastewater pollutes 8 litres of freshwater, the present burden of pollution may be up to 12,000 km3 worldwide. As ever, the poor are the worst affected, with 50 percent of the population of developing countries exposed to polluted water sources (UNWWAP, pp.9-10).

Moreover, UNWWDR explains that the precise impact of climate change on water resources is uncertain. Precipitation will probably increase from latitudes 30oN and 30oS, but many tropical and sub-tropical regions will probably get lower and more erratic rainfall. With a discernable trend towards more frequent extreme weather conditions, it is likely that floods, droughts, mudslides, typhoons and cyclones will increase. Stream flows at low-flow periods may well decrease and water quality will undoubtedly worsen, because of increased pollution loads and concentrations and higher water temperatures. We have made good progress in understanding the nature of water in its interaction with the biotic and abiotic environment. We have better estimates of climate change impacts on water resources. Over the years, our understanding of hydrological processes has enabled us to harvest water resources for our needs, reducing the risk of extreme situations. But pressures on the inland water system are increasing with population growth and economic development. Critical challenges lie ahead in coping with progressive water shortages and water pollution. By the middle of this century, at worst 7 billion people in sixty countries will be water-scarce, at best 2 billion people in forty-eight countries (UNWWAP 2003, p.10).

3.3 Challenges of Contemporary Water Management within Socioeconomic Context

The UN World Water Development Report 2 (UNWWDR) mentions that the key challenges of contemporary water management can only be understood within the very broad context of the world's socioeconomic systems. The problem we face today is largely one of governance: equitably sharing this water while ensuring the sustainability of natural ecosystems. At this point in time, we have not yet achieved this balance. Decisions on water management are a top priority. Who has the right to water and its benefits? Who is making water allocation decisions on who is supplied with water - and from where, when and how? There are many demands made on the world's water resources: drinking, hygiene, food, energy and industrial goods, and the maintenance of

natural ecosystems. Global water resources, however, are limited and unevenly distributed. This complicates water management, particularly for decision-makers, who are faced with the challenge of managing and developing water resources in a sustainable fashion in the face of the pressures of economic growth, major population increases and climate change (UNWWAP 2006, pp.3-6).

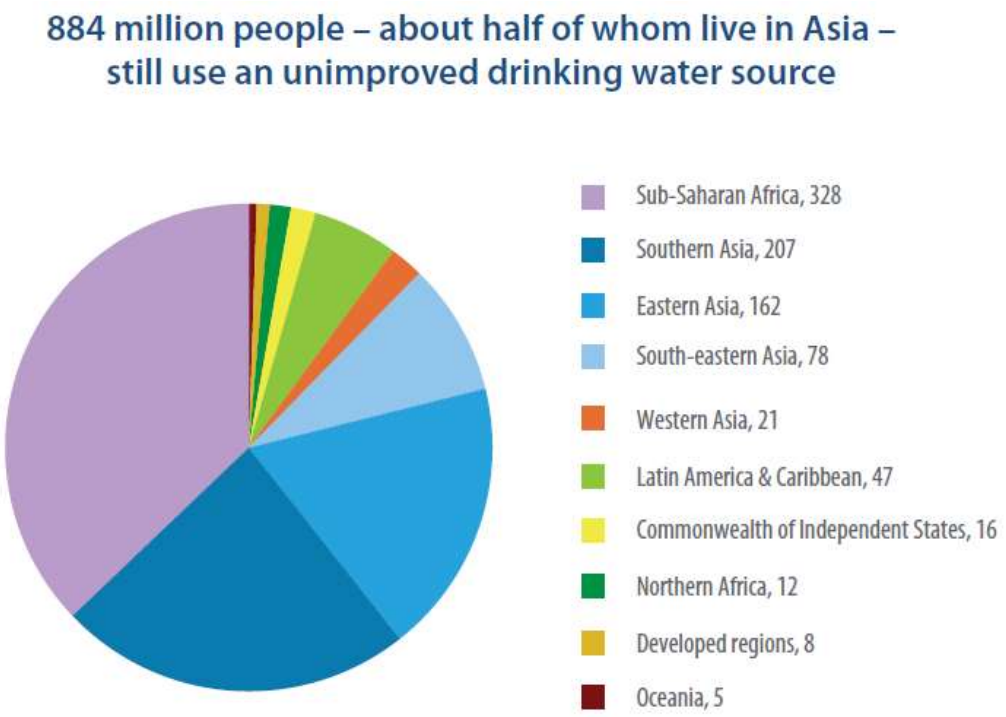
UNWWDR 2 explains that the state of human health is inextricably linked to a range of water-related conditions: safe drinking water, adequate sanitation, minimized burden of water-related disease and healthy freshwater ecosystems. Urgent improvements in the ways in which water use and sanitation are managed are needed to improve progress towards meeting the Millennium Development Goals (MDGs) related to human health. In the last decade, 90 percent of natural disasters have been water-related events. Tsunamis, floods, droughts, pollution and storm surges are just a few examples of hazards that can constitute a risk for societies and communities. These are likely to increase in the changing environmental context. Hazards like these become disasters when risks are not managed with the objective of reducing human vulnerability. Floods and droughts are the most deadly freshwater disasters, disrupting socio-economic development in particular in developing countries. Efforts to reduce disaster risks must be systematically integrated into policies, plans and programmes for sustainable development and poverty reduction (UNWWAP 2006, pp.18-20)

UNWWDR 2 explains that the focus of the emerging water culture is water sharing: Integrated Water Resources Management (IWRM) looks for more effective and equitable management of water through increased cooperation. Bringing together institutions dealing with surface water and aquifer resources, calling for new legislative agreements worldwide, raising public participation, and exploring alternative solutions to resolving disputes, are all part of the process. The availability and affordability of water is of growing political and economic concern. Growing populations and rising incomes stimulate the demand for improved water supply and sanitation services, both directly and indirectly through demand for food, manufactured products, energy and environmental services. Given its unique life-sustaining properties and innumerable roles, water incorporates many values - social, cultural and environmental, as well as economic. All of these must be considered in designing water-related policies and programmes if equitable, efficient and environmentally sustainable management of water resources is to be achieved (UNWWAP 2006, pp.33-39)

Figure 2: Drinking water coverage 2006 (World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation

(JMP) 2008)

Figure 3: Population using an unimproved drinking water source, by region in 2006 (millions) (World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation (JMP) 2008)



3.4 Water in a Changing World

The United Nations World Water Development Report 3 indicate three messages:

1) Leaders in the water sector – in water supply and sanitation, hydropower, irrigation and flood control – have long been aware that water is essential to sustainable development, but they do not make the decisions on development objectives and the allocation of human and financial resources to meet them. These decisions are made or influenced by leaders in government, the private sector and civil society, who must learn to recognize water's role in obtaining their objectives;

2) Water is essential for achieving sustainable development and the Millennium Development Goals. Properly managing water resources is an essential component of growth, social and economic development, poverty reduction and equity and sustainable environmental services – all essential for achieving the Millennium Development Goals;

3) Water is linked to the crises of climate change, energy and food supplies and prices, and troubled financial markets. Unless their links with water are addressed and water crises around the world are resolved, these other crises may intensify and local water crises may worsen, converging into a global water crisis and leading to political insecurity and conflict at various levels (UNWWAP 2009, p.3).

4 Power, Poverty and Global Water Crisis

4.1 Dealing with Climate Change

Human Development Report 2006 (HDR 2006) explains that climate change is transforming the nature of global water insecurity. While the threat posed by rising temperatures is now firmly established on the international agenda, insufficient attention has been paid to the implications for vulnerable agricultural producers in developing countries. The Framework Convention on Climate Change adopted in 1992 warned governments that "where there are risks of serious and irreversible damage, lack of full scientific certainty should not be used as a reason for postponing action". Few warnings have been more perilously ignored (Watkins, p.27).

HDR 2006 continues that global warming will transform the hydrological patterns that determine the availability of water. Modeling exercises point to complex outcomes that will be shaped by micro-climates. But the overwhelming weight of evidence can be

summarized in a simple formulation: many of the world's most water-stressed areas will get less water, and water flows will become less predictable and more subject to extreme events. Among the projected outcomes:

1) Marked reductions in water availability in East Africa, the Sahel and Southern Africa as rainfall declines and temperature rises, with large productivity losses in basic food staples. Projections for rain-fed areas in East Africa point to potential productivity losses of up to 33% in maize and more than 20% for sorghum and 18% for millet;

2) The disruption of food production systems exposing an additional 75–125 million people to the threat of hunger;

3) Accelerated glacial melt, leading to medium-term reductions in water availability across a large group of countries in East Asia, Latin America and South Asia;

4) Disruptions to monsoon patterns in South Asia, with the potential for more rain but also fewer rainy days and more people affected by drought;

5) Rising sea levels resulting in freshwater losses in river delta systems in countries such as Bangladesh, Egypt and Thailand.

The international response to the water security threat posed by climate change has been inadequate (Watkins, pp.27-28).

4.2 Managing Water Scarcity, Risk and Vulnerability

Human Development Report 2006 says that in the early 21st century debates on water increasingly reflect a Malthusian diagnosis of the problem. Dire warnings have been posted pointing to the "gloomy arithmetic" of rising population and declining water availability. Is the world running out of water? Not in any meaningful sense. But water insecurity does pose a threat to human development for a large—and growing—section of humanity. Competition, environmental stress and unpredictability of access to water as a productive resource are powerful drivers of water insecurity for a large proportion of the global population. Viewed at a global level, there is more than enough water to go around and meet all of humanity's needs. So why is water scarcity a problem? Partly because water, like wealth, is unequally distributed between and within countries (figure 12). It does not help water-stressed countries in the Middle East that Brazil and Canada have more water than they could ever use. Nor does it help people in drought-prone areas of northeast Brazil that average water availability in the country is among the highest in the world. Another problem is that access to water as a productive resource requires access to infrastructure, and access to infrastructure is also skewed between and within countries (Watkins, pp.25-26).

HDR 2006 continues that measured on conventional indicators, water stress is increasing. Today, about 700 million people in 43 countries live below the water-stress threshold of 1,700 cubic metres per person—an admittedly arbitrary dividing line. By 2025 that figure will reach 3 billion, as water stress intensifies in China, India and Sub-Saharan Africa. Based on national averages, the projection understates the current problem. The 538 million people in northern China already live in an intensely water-stressed region. Globally, some 1.4 billion people live in river basin areas where water use exceeds sustainable levels. Water stress is reflected in ecological stress. River systems that no longer reach the sea, shrinking lakes and sinking groundwater tables are among the most noticeable symptoms of water overuse. The decline of river systems—from the Colorado River in the United States to the Yellow River in China—is a highly visible product of overuse. Less visible, but no less detrimental to human development is rapid depletion of groundwater in South Asia. In parts of India groundwater tables are falling by more than 1 metre a year, jeopardizing future agricultural production (Watkins, p.26).

Then HDR 2006 concludes that these are real symptoms of scarcity, but the scarcity has been induced by policy failures. When it comes to water management, the world has been indulging in an activity analogous to a reckless and unsustainable credit-financed spending spree. Put simply, countries have been using far more water than they have, as defined by the rate of replenishment. The result: a large water-based ecological debt that will be transferred to future generations. This debt raises important questions about national accounting systems that fail to measure the depletion of scarce and precious natural capital—and it raises important questions about cross-generational equity. Underpricing (or zero pricing in some cases) has sustained overuse: if markets delivered Porsche cars at give-away prices, they too would be in short supply. Future water-use scenarios raise cause for serious concern. For almost a century water use has been growing almost twice as fast as population. That trend will continue. Irrigated agriculture will remain the largest user of water—it currently accounts for more than 80% of use in developing countries. But the demands of industry and urban users are growing rapidly. Over the period to 2050 the world’s water will have to support the agricultural systems that will feed and create livelihoods for an additional 2.7 billion people. Meanwhile, industry, rather than agriculture, will account for most of the projected increase in water use to 2025 (Watkins, p.26).

4.3 Power, Water and Money: Exploring the Nexus

Erik Swyngedouw insists that providing safe and clean water to communities is not exactly rocket science: the basic technologies and engineering principles are known and mastered (although there is always scope for improvement of course), management systems understood, aquatic bio-chemical and physical processes well comprehended. Despite the relative technological and managerial ease of providing clean water for all and of evacuating and treating wastewater, it is remarkable that more than one billion people worldwide are still suffering from inadequate, unreliable (both in quantity and quality) and/or difficult access to clean water and almost two billion form unsatisfactory sanitation. While the humanitarian and socio-economic costs of inadequate water and sanitation services are well known, progress in alleviating water problems remains excruciatingly and unacceptably slow. The annual number of premature deaths or the persistence of debilitating conditions actually suffered by the poor of the world as a result of inadequate water supply far outweigh even the most pessimistic predictions of the human consequences of global warming. Yet, it would be remarkably easy to remedy this. With the possible exception of very arid regions, conditions of problematic water access have little, if anything at all, to do with water availability or absolute scarcity. It usually is a problem of access and equitable distribution of the available resources. What need to be understood better, therefore, is not how to bring water to people, but, rather, why it is that some social groups do not have adequate access to water and sanitation, while others do (Swyngedouw, p.4).

He continues that while the MDGs are committed to a significant increase of the number of people that have improved access to clean water and adequate sanitation, particularly to the poor, it can now be confidently predicted that, unless a significant effort is made from the part of national and trans-national institutions, conditions will only have improved marginally, if at all, by 2015. Despite rhetorical commitment and political support, eradicating water poverty meets with significant barriers and difficulties. The background paper of Human Development Report 2006 by UNDP will address a relatively neglected aspect of the water problem. In particular, attention will be paid to the relationship between social power and water circulation and water access. In other words, it will be argued that access to or exclusion from access to water is largely determined by relative power positions of individuals and social groups vis-à-vis each other. In other words, we argue that a focus on ‘the poor’ is not necessarily particularly helpful in assessing and understanding processes of access to or exclusion from access to water and sanitation. The key question is to understand why some groups in particular social and geographical location have unlimited access to water while others have no or unsatisfactory access. The paper pays relatively little attention to the

problematic conditions of water access for many people around the world and the difficulties encountered in changing this condition. This is sufficiently known (Gleick 1993; UNHSP 2003). Its focus is on the social power relations that produce decidedly uneven conditions through which socio-spatially stratified water access conditions are actively produced and maintained (Swyngedouw, pp.4-5).

Then he concludes that the terrestrial part of the hydrological cycle is considered as fundamentally a hydro-social cycle (Swyngedouw, Kaïka, and Castro 2002). The water flows embodied in the networks that function as conduits for this cycle would narrate many interrelated tales: of social and political actors and the powerful socio-ecological processes that produce urban and regional spaces; of participation and exclusion; of rats and bankers; of water-borne disease and speculation in water-industry related futures and options; of chemical, physical and biological reactions and transformations; of the global hydrological cycle and global warming; of uneven geographical development; of the political lobbying and investment strategies of dam builders; of urban land developers; of the knowledge of engineers; of the passage from river to urban reservoir. The rhizome of underground and surface water flows, of streams, pipes and networks is a powerful metaphor for processes that are both social and ecological (Kaika and Swyngedouw 2000). Water is a 'hybrid' thing that captures and embodies processes that are simultaneously material, discursive and symbolic. Water networks connect the most intimate of socio-spatial relations, insert them into a mesmerizing political-economy of urban, national and international development, and are part of a chain of local, regional, national and global circulations of water, money, texts and bodies. In this sense, water embodies bio-chemical and physical properties, cultural and symbolic meanings, and socio-economic characteristics simultaneously and inseparably. These multiple metabolisms of water are structured and organized through socio-natural power relations --- relations of domination and subordination, of access and exclusion, of emancipation and repression --- which then become etched into the flow and metabolisms of circulating water. This circulation of water is embedded in and interiorises a series of multiple power relations along ethnic, gender and class lines (see (Swyngedouw 1996a)). These situated power relations, in turn, swirl out and operate at a variety of interrelated geographical scale levels, form the scale of the body upward to the political-ecology of the city to the global scale of uneven development. The capturing, sanitizing, and bio-chemical metabolizing of water to produce 'urban' drinking or agricultural irrigation water simultaneously homogenizes, standardizes, and transforms it into a commodity as well as into the real-abstract homogenized qualities of money power in its manifold symbolic, cultural, social, and economic meanings

(Swyngedouw, p.5).

5 Water Privatization and Reclaiming Public Water

5.1 Water Privatization Fiasco

Public Citizen (PC) explains that the role of multinational corporations in providing water and sanitation services is relatively new. In fact, one could say water 'privatization' is a global social experiment. Historically, water has been viewed as a public good, not a market commodity. Over the last 200 years, most water utilities have been publicly owned and managed. And, the vast majority of people around the world receive water and sanitation services from publicly owned and operated facilities. Most countries have only recently begun to consider privatization of their water utilities. Only 5% of the world's water services are run by private companies. Water and sanitation services have been publicly run because private companies were not interested in owning or managing water utilities. There was little or no profit to be made. But, with the specter of growing freshwater scarcity and the prediction that water will be the oil of the 21st century, major global corporations have been moving into the 'water market'. The multinational water corporations, their government allies, the IMF, the World Bank and the regional development banks have claimed that water privatization (or public/private partnerships) is the answer. They claim that bringing the private sector into water and sanitation service provision will ensure access to the more than a billion people worldwide who lack clean and affordable water, and the 2.4 billion who lack sanitation services. The water corporations and their allies argue that the private sector is more efficient, cost-effective and competitive. And, the private sector can bring needed financing. Many cases show that very few of these claims are borne out in practice (Public Citizen, p.1).

PC continues that in recent years several showcase water privatizations have suffered major losses. Cases in Buenos Aires, Manila, Atlanta and Cochabamba are presented below. Conflict-ridden water privatizations in Indonesia, South Africa, and the United Kingdom are also analyzed. What has now become clear is that the major multinational water corporations have no intention of making a significant contribution to the capital needed to ensure access to clean and affordable water. The rhetoric of private sector financing is a myth. There is no commitment to universal access to clean and affordable water unless significant profit can be guaranteed. These profit ratios have

not been quickly nor easily forthcoming in the developing world. Now the water corporations are demanding new loans, guarantees, and currency exchange insurance from governments and the international financial institutions (IFIs). And, in some cases, if they don't get it, they are pulling out. The claim that the multinational water corporations will save government money by providing more efficient and cost-effective operation, maintenance and rehabilitation of water and sanitation services is also not borne out in practice. Instead, the cases presented below show increases in consumer water rates, public health crises, weak regulation, lack of investment in water infrastructure, jobs and trade unions threatened, pollution and other environmental catastrophes, secret deals and social turmoil (Public Citizen, p.1).

PC concludes that public water utilities in many countries have been unable to provide universal access to water and sanitation services. Two decades of IMF and World Bank structural adjustment programs that cut government budgets, including government subsidies to water utilities, have worsened the problem. While it is laudable that, in recent years, there has been new-found attention to the fact that millions go without access to clean and affordable water, this new global awareness should not provide profit-making business opportunities for multinational corporations. Civil society activists are clear that the solutions will not come from the global water corporations, but rather from grassroots democratic initiatives and increased government accountability to the demands of citizens and civil society organizations, including environmental groups, women's groups, religious organizations, trade unions, farmers' organizations, students and many others (Public Citizen, pp.1-2).

5.2 Failure of Water Privatization

Mary Ann Manahan et al. mention that Asia shows the highest number of people unserved by either water supply or sanitation. Seven hundred fifteen million people in Asia have no access to safe drinking water, while 1.9 billion or 80 percent of the population has no access to sanitation. Immense numbers give an indication of the extent of the problem, but the urgency of the matter comes from the understanding that this water crisis is largely a problem of 'governance', i.e. equitably sharing the world's freshwater while ensuring the sustainability of natural ecosystems. In achieving this balance, the main issue for many governments, water advocates, and stakeholders in the water sector is identifying the best model for improving peoples' access to safe and affordable drinking water (Manahan et al., p.1).

They explain that while public utilities and communities are still the main actors for

water supply and sanitation and resource management in Asian countries, governments and international financial institutions (IFIs) aim to expand the role of private water corporations in water delivery. With the pretext that the private sector has the financial, technological and technical capacities to improve water delivery, IFIs such as the World Bank (WB) and Asian Development Bank (ADB) continue to push for various forms of privatization, through conditions to loans, policy prescriptions or technical assistance. Unfortunately also the Asia Pacific Water Summit in Oita, Japan (December 2007) reflected this stubborn bias (Manahan et al., p. 1).

Then they insist that the pro-privatization approach is primarily ideology-driven, as the private concession model of water service provision has been tried in Asian major cities, from India to the Philippines – and clearly failed. Far from ensuring universal access and coverage of water, the reality of many privatization projects has been skyrocketing water prices, unfixed broken pipes, laying-off skilled workers, exacerbating unequal access to safe and affordable water and improved sanitation, increased debts, under-investment, etc. Against the reality of these experiences, the last few years were marked with many social mobilizations, consolidation of forces, victories and hard-won battles for peoples and communities' water struggles, particularly in defending water as a human right (Manahan et al., p.1).

5.3 Alternatives to Privatization

Manahan et al. explain their essay collection as follows. This collection of 19 new essays written by civil society activists, trade unionists and other water practitioners, presents examples of ongoing struggles against water privatization and commercialization as well as inspiring examples of people-centered public water management from across Asia. We hope this compilation will not only be a source of inspiration for those struggling for water for all in communities all over the continent, but also that it will contribute to strengthening the discussion about the ways forward for public water delivery in Asia. The papers show that the ideology-driven privatization wave has now also reached Asian countries where public water delivery has been very successful. Examples include like Malaysia, Hong Kong, Korea and Japan, where public utilities have largely achieved water for all. But despite universal coverage, high quality drinking water and sanitation, very low leakage levels and many other indicators of successful public services, the governments of Hong Kong, Korea and Japan are planning to boost the role of the private sector. In Malaysia, this process has already resulted in widespread privatization and predictable problems (such as

tariffs hiking impacting the affordability of water for the poorest) resulting from this (Manahan et al., p.1).

They continue that the essay collection also covers India, Cambodia, Indonesia and many other Asian countries where large parts of the population have for far too long remained without adequate access to water and sanitation, but where concrete, workable alternatives to water privatization exist. Public water solutions are being developed and implemented in numerous Asian countries, i.e. progressive public water management models, often involving new forms of local cooperation between public water operators, communities, trade unions and other key groups. Experiences in the Indian states Tamil Nadu and Kerala show that empowerment of communities and the democratization of governance are strong positive tools for improving public water supply. Appropriate technology and a focus on sustainable water solutions, the Tamil Nadu experience shows, can moreover result in major cost savings that allow more people to get access to clean water. An important new trend is the emergence of public-public partnerships (PUPs), in which a well-performing water operator assists a utility in need of support. This essay collection includes examples of domestic PUPs from Indonesia and Cambodia. PUPs, including cross-border partnerships between utilities, are likely to get a major boost through the UN's new 'water operator partnerships' (WOPs) initiative, which is geared towards facilitating cooperation among utilities on a not-for-profit basis (Manahan et al., pp.1-2).

Then they insist that clearly, numerous public water utilities in large parts of Asia fail to supply safe water for all, but privatization is not the answer. There is no lack of workable public service reform approaches that could dramatically improve access to water supply and sanitation for millions of people across the continent, if the political will would be there. However diverse these people-centered public water approaches are, the following words of an elected official from Tamil Nadu captures the essence:

"Only through a partnership between people who have suffered for want of water and water agencies who believe in democratic functioning can we ensure safe, equitable and adequate water and understand the need for conservation of resources and ensuring sustainable water systems" (Manahan et al., p.2).

5.4 Reclaiming Public Water

Belen Balanya et al. explains that due to the ideological obsession with private sector promotion in the last decade, the question, how public water can work, has not received a fraction of the attention it deserves in policy debates and decision-making.

There is now a fundamentally new situation as a result of the many high-profile privatization failures, the withdrawal from developing countries by private water multinationals, and the realization among even privatization proponents that private investment will not deliver for the poor. It is necessary to refocus on amplifying the performance and coverage of public utilities. Significant improvements in access to clean water and sanitation have been achieved by diverse forms of public water management. These people-centered public water solutions have occurred under a variety of socio-economic, cultural and political circumstances. Examples include the accomplishments of public utilities and co-operatives in Porto Alegre (Brazil), Santa Cruz (Bolivia) and Penang (Malaysia); the improvements realized by innovative public delivery models in Caracas (Venezuera), Harrismith (South Africa) and the province of Buenos Aires (Argentina); and the achievements of community-managed water in Olavanna (Kerala, India) and Savelugu (Ghana). These diverse public approaches have all proved their potential for improving water delivery, not least to the poorest (Balanya et al, p.247).

Then they continue that these achievements have happened against lots of obstacles. Among the worst are the systematic bias against public water of international financial institutions and the privatization conditionalities attached to the decreasing amounts of development aid offered by northern governments. The political, financial, and other hurdles prevent public water management from achieving its full potential. Strengthening the democratic, public character of water service is fundamentally at odds with the currently dominant neoliberal model of globalization, which subordinates ever more areas of life to the harsh logic of global markets. In many cities citizens and user participation in various forms is an essential factor behind the improvements in effectiveness, responsiveness and social achievements of the water utility (Balanya, pp248-249).

5.5 Movements, Struggles and Public Water Solutions

Balanya et al. insist that social movements contribute actively to preserving and improving the public character of water and sanitation services around the world. By exerting public pressure on governments and utilities to change and improve access to clean water, such movements have a key role in achieving sustainable water for all. In many countries, social movements are mobilizing to defend the interests of marginalized people against the neoliberal policies promoted by political and economic elites. Social justice and democratization of water management decision-making are

integrally linked. Anti-privatization campaign coalitions in countries around the world go beyond mere resistance. These movements, uniting a broad range of actors, from environmentalists, women's groups and grassroots community activists to trade unions, political parties and public utility managers, have often very elaborate visions and concrete proposals for public sector alternatives (Balanya et al., p.266-267).

Human Development Report 2006 explains the key role of public provider as follows. In recent years international debate on the human right to water has been dominated by polarized exchanges over the appropriate roles of the private and public sectors. Important issues have been raised—but the dialogue has generated more heat than light. Some privatization programmes have produced positive results. But the overall record is not encouraging. From Argentina to Bolivia, and from the Philippines to the United States, the conviction that the private sector offers a 'magic bullet' for unleashing the equity and efficiency needed to accelerate progress towards water for all has proven to be misplaced. While these past failures of water concessions do not provide evidence that the private sector has no role to play, they do point to the need for greater caution, regulation and a commitment to equity in public-private partnerships (Watkins, pp.21-22).

In sum, HDR 2006 conclude that two specific aspects of water provision in countries with low coverage rates caution against an undue reliance on the private sector. First, the water sector has many of the characteristics of a natural monopoly. In the absence of a strong regulatory capacity to protect the public interest through the rules on pricing and investment, there are dangers of monopolistic abuse. Second, in countries with high levels of poverty among unserved populations, public finance is a requirement for extended access regardless of whether the provider is public or private. The debate on privatization has sometimes diverted attention from the pressing issue of public utility reform. Public providers dominate water provision, accounting for more than 90% of the water delivered through networks in developing countries. Many publicly owned utilities are failing the poor, combining inefficiency and unaccountability in management with inequity in financing and pricing. But some public utilities—Porto Alegre in Brazil is an outstanding example—have succeeded in making water affordable and accessible to all. There are now real opportunities to learn from failures and build on successes. The criterion for assessing policy should not be public or private but performance or nonperformance for the poor (Watkins, p.22).

6 Water Justice and the Right to Water

6.1 The Right to Water as a Human Right

World Health Organization (WHO) mentions that we have entered the new millennium with one of the most fundamental conditions of human development unmet: universal access to water. Of the world's 6 billion people, at least 1.1 billion lack access to safe drinking-water. The lives of these people who are among the poorest on our planet are often devastated by this deprivation, which impedes the enjoyment of health and other human rights such as the right to food and to adequate housing. Water is the essence of life and human dignity. Water is fundamental to poverty reduction, providing people with elements essential to their growth and development. Recently, the Committee on Economic, Social and Cultural Rights, which monitors the implementation of the Covenant, adopted General Comment No. 15 in which water is recognized, not only as a limited natural resource and a public good but also as a human right. The right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water, and it must be enjoyed without discrimination and equally by women and men. At the Millennium Summit, States agreed to halve, by 2015, the proportion of people without access to safe drinking-water. WHO issued the report as a contribution to the International Year of Freshwater, celebrated worldwide throughout 2003 as an immense opportunity to highlight and promote the right to water as a fundamental human right (WHO, p.3).

6.2 Evolution of Water and Health-related Human Rights

WHO explains that in 2000, the United Nations Committee on Economic, Social and Cultural Rights, the Covenant's supervisory body, adopted a General Comment on the right to health that provides a normative interpretation of the right to health as enshrined in Article 12 of the Covenant. This General Comment interprets the right to health as an inclusive right that extends not only to timely and appropriate health care but also to those factors that determine good health. These include access to safe drinking-water and adequate sanitation, a sufficient supply of safe food, nutrition and housing, healthy occupational and environmental conditions, and access to health-related education and information. In 2002, the Committee further recognized that water itself was an independent right. Drawing on a range of international treaties and declarations, it stated: "the right to water clearly falls within the category of guarantees essential for securing an adequate standard of living, particularly since it is

one of the most fundamental conditions for survival" (WHO, p.8)

WHO continues that regardless of their available resources, all States Parties have an immediate obligation to ensure that the minimum essential level of a right is realized. In the case of water, this minimal level includes ensuring people's access to enough water to prevent dehydration and disease. Other immediate and inexpensive obligations include non-discrimination and the respect and protection of the existing enjoyment of rights. The recognition that the realization of human rights is dependent upon resources is embodied in the principle of progressive realization. This principle mandates the realization of human rights within the constraints of available resources. It also creates a constant and continuing duty for States to move quickly and effectively towards the full realization of a right. This neither requires nor precludes any particular form of government or economic system being used to bring about such change. Steps towards the full realization of rights must be deliberate, concrete and targeted as clearly as possible towards meeting the human rights obligations of a government (WHO, 2002) and may include legislative, administrative, financial, educational and social measures or the provision of remedies through the judicial system (WHO, p.9).

6.3 Rights-based Approach to Development

WHO asks why defining water as a human right makes a difference, and answers. Ensuring that access to sufficient safe water is a human right constitutes an important step towards making it a reality for everyone. It means that:

1) fresh water is a legal entitlement, rather than a commodity or service provided on a charitable basis;

2) achieving basic and improved levels of access should be accelerated;

3) the 'least served' are better targeted and therefore inequalities decreased;

4) communities and vulnerable groups will be empowered to take part in decision-making processes;

5) the means and mechanisms available in the United Nations human rights system will be used to monitor the progress of States Parties in realizing the right to water and to hold governments accountable (WHO, p.9).

WHO mentions that approaching development from a rights perspective informs people of their legal rights and entitlements, and empowers them to achieve those rights. Rather than seeing people as passive recipients of aid, the rights-based approach puts the individual at the centre of development. A rights-based approach has implications for a range of actors concerned directly or indirectly with water issues. Governments, as

primary duty-bearers, must take concrete steps to respect, protect and fulfill the right to water and other water-related rights and to ensure that anyone operating within their jurisdiction - individuals, communities, civil society, and the private sector - do the same. This means paying attention to these rights also in processes, ensuring the right of beneficiaries to participate in decision-making that affects them and guaranteeing transparency so that individuals have access to information and are able to understand, interpret, and act on the information available to them (WHO, pp.9-10).

Moreover, according to WHO, a rights-based approach is also premised upon the principle of freedom from discrimination and equality between men and women. This is closely linked to the issue of accessibility. For example, the right to water specifically rules out exclusion from needed services according to ability to pay. This is crucial in ensuring the delivery of services to the poor. A central feature of a rights-based approach is the notion of accountability, which in practice requires the development of adequate laws, policies, institutions, administrative procedures and practices, and mechanisms of redress. This calls for the translation of the internationally recognized right to water into locally determined benchmarks for measuring progress, thereby enhancing accountability. A rights-based approach may deliver more sustainable solutions because decisions are focused on what communities and individuals require, understand and can manage, rather than what external agencies deem is needed (WHO, p.10).

7 Water Democracy and Water Commons

7.1 Beyond Scarcity: Power, Poverty and the Global Water Crisis

The UN Human Development Report 2006 analyzes the relationship of power, poverty and the global water crisis. The global crisis in water consigns large segments of humanity to lives of poverty, vulnerability and insecurity. The scarcity at the heart of the global water crisis is rooted in power, poverty and inequality, not in physical availability. Ensuring that every person has access to at least 20 littles of clean water each day is a minimum requirement for respecting the human right to water. “Not having access” to water and sanitation is a polite euphemism for a form of deprivation that threatens life, destroys opportunity and undermines human dignity. Water and sanitation are among the most powerful preventive medicines available to governments to reduce infectious disease. The criterion for assessing policy should not be public or

private but performance or nonperformance for the poor. Even more than water, sanitation suffers from a combination of institutional fragmentation, weak national planning and low political status. Community-led initiatives are important, but they are not a substitute for government action – and private financing by poor households is not a substitute for public finance and service provision (Watkins, pp.1-24).

HDR 2006 continues that scarcity has been induced by policy failures – when it comes to water management, the world has been indulging in an activity analogous to a reckless and unsustainable credit-financed spending spree. Climate change is transforming the nature of global water insecurity. International aid for adaptation ought to be a cornerstone of the multilateral framework for dealing with climate change. Outcomes for the poorest, most vulnerable people in society will be determined by the way institutions mediate and manage rival claims – and by whether governments put equity concerns at the center of national policies. Transboundary water governance is a human development issue: cooperation can reduce the potential for conflict and unlock benefits by improving the quality of shared water, generating prosperity and more secure livelihoods. Unclean water and poor sanitation have claimed more lives over the past century than any other cause (Watkins, pp.1-24).

7.2 A New Freshwater Narrative: Our Water Commons

Maude Barlow mentions that the world's water crisis due to pollution, climate change and a surging population growth is of such magnitude that close to two billion people now live in water-stressed regions of the planet. By the year 2025, two-thirds of the world's population will face water scarcity. The global population tripled in the twentieth century, but water consumption went up sevenfold. By 2050, after we add another three billion to the population, humans will need an 80 percent increase in water supplies just to feed ourselves. No one knows where this water is going to come from (Barlow 2007a). The time has come to turn our attention to the earth's declining fresh water supplies. Water is the most crucial Commons, one of the very few things on which everyone is dependent, and approaching the future of water through the Commons lens offers the possibility of a path to a sane and just future of water use and management (Barlow 2007b, p.1).

She insists that there are two competing narratives about the earth's fresh water resources being played out in the 21st century. On one side is a powerful clique of decision-makers, heads of some powerful states, international trade and financial institutions and transnational corporations who do not view water as part of the global

Commons or a public trust, but as a commodity, to be bought and sold on the open market. On the other is a global grassroots movement of local communities, the poor, slum dwellers, women, indigenous peoples, peasants and small farmers working with environmentalists, human rights activists, progressive water managers and experts in both the global North and the global South who see water as a Commons and seek to provide water for all of nature and all humans. We see the tense --- and globally threatening --- relationship between these two prominent narratives and point to ways that the life affirming water Commons can be used as a framework to bring water justice to all (Barlow 2007b, p.1).

7.3 Blue Covenant: Water Conservation, Water Justice and Water Democracy

Maude Barlow insists that the three water crises – dwindling freshwater supplies, inequitable access to water and the corporate control of water – pose the greatest threat of our time to the planet and to our survival. Together with impending climate change from fossil fuel emissions, the water crises impose some life-death decisions on us all. Unless we collectively change our behavior, we are heading toward a world of deepening conflict and potential wars over the dwindling supplies of freshwater – between nations, between rich and poor, between the public and the private interest, between rural and urban populations, and between the competing needs of the natural world and industrialized humans (Barlow 2007).

She continues that humanity still has a chance to head off these scenarios of conflict and war. We could start with a global covenant on water. The Blue Covenant should have three components: water conservation covenant from people and their governments that recognizes the right of the Earth and of other species to clean water, and pledges to protect and conserve the world's water supplies; a water justice covenant between those in the global North who have water and resources and those in the global South who do not, to work in solidarity for water justice, water for all and local control of water; and a water democracy covenant among all governments acknowledging that water is a fundamental human rights for all. Therefore, governments are required not only to provide clean water to their citizens as a public service, but they must also recognize that citizens of other countries have the rights to water as well as and to find peaceful solutions to water disputes between states (Barlow 2007).

She concludes that the global water justice movement is demanding a change in international law to settle once and for all the question of who controls water. It must be commonly understood that water is not a commercial good, although of course it has an

economic dimension, but rather a human right and a public trust. What is needed now is binding law to codify that states have the obligation to deliver sufficient, safe, accessible and affordable water to their citizens as a public service. While “water for all, everywhere and always” may appear to be self-evident, the fact is that the powers moving in to take corporate control of water have resisted this notion fiercely. So have many governments, either because, in the case of rich governments, their corporations benefit from the commodification of water or, in the case of poor governments, because they fear they would not be able to honor this commitment. Groups around the world are mobilizing in their communities and countries for constitutional recognition of the right to water within their borders and at the United Nations for a full treaty that recognizes the right to water internationally (Barlow 2007).

7.4 The Principles of Water Democracy

Vandana Shiva analyzes the historical erosion of communal water rights. Examining the international water trade, damming, mining, and aquafarming, she exposes the destruction of the earth and the disenfranchisement of the world’s poor as they are stripped of their rights to a precious common good. She also cerebrates the spiritual and traditional role water has played in communities throughout history, and warns that water privatization threatens cultures and livelihoods worldwide (Shiva).

She mentions that at the core of the market solution to pollution is the assumption that water exists in unlimited supply. The idea that markets can mitigate pollution by facilitating increased allocation fails to recognize that water diversion to one area comes at the cost of water scarcity elsewhere. In contrasts to the corporate theorists who promote market solutions to pollution, grassroots organizations call for political and ecological solutions. Communities fighting high-tech industrial pollution have proposed the Community Environmental Bill of Rights, which includes rights to clean industry; to safety from harmful exposure; to prevention; to knowledge; to participation; to protection and enforcement; to compensation; and to cleanup. All of these rights are basic elements of a water democracy in which the right to clean water is protected for all citizens. Markets can guarantee none of these rights (Shiva, p.34).

She continues that there are nine principles underpinning water democracy:
1) Water is nature’s gift; 2) Water is essential to life; 3) Life is interconnected through water; 4) Water must be free for sustenance needs; 5) Water is limited and can be exhausted; 6) Water must be conserved; 7) Water is a commons; 8) No one holds a right to destroy; 9) Water cannot be substituted (Shiva, pp.34-36).

8 Conclusions

The study of environmental harm/crime and practical politics of environmental protections is an important conundrum. It is addressed whether the harmful policies and practices against environment can be characterized as a form of crime, and whether environmental harms/crimes of globalization need to receive special attention.

Rob White addresses the conceptual foundation for a political economy of environmental harm, reviews the criminological study of environmental harm, and examines how production and consumption are organized within capitalist society. Complementing a political economy of environmental harm is the literature in theoretical environmentalism, in which "sustainability" is currently deployed globally as a political catchphrase that engenders a vague sense of goodwill toward the Third World, and the environment generally, but has done little to radically shift us away from top-down development strategies and oppressive global trading practices (White).

We must envision an alternative that provides basic human needs: water, food, clothing, shelter, energy, security, and so on. These basic human rights are the essence of democracy and quality of human life, and can be compatible with environment. A social reconstruction is called for which is based on new narrative based not on the death of nature or mechanistic science, but on a partnership with nature and environment. By the middle of the 21st century, we will be compelled to accept a different set of assumptions about production, reproduction, consumption, ecology, and consciousness, constituting a global ecological revolution (White).

The global crisis in water consigns large segments of humanity to lives of poverty, vulnerability and insecurity. The scarcity at the heart of the global water crisis is rooted in power, poverty and inequality, not in physical availability. Citizens have the right to water. Not having access to water and sanitation is a form of deprivation that threatens life, destroys opportunity and undermines human dignity. The harmful policies and practices against environment can be characterized as a form of crime, and environmental harms/crimes of globalization need to receive special attention. Facing the serious global water crisis, we do struggle for 'water justice and water democracy'.

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Crisis of Global Biodiversity and Complexity Green Criminology

1 Introduction

Global Biodiversity Outlook 3 (2010), produced by the Convention on Biological Diversity, made a new assessment of the current state of biodiversity and the implications of its continued loss for human well-being as follows. "Natural systems that support economies, lives and livelihoods across the planet are at risk of rapid degradation and the collapse, unless there is swift, radical and creative action to conserve and sustainably use the variety of life on Earth."

The Outlook 3 warns that massive further loss of biodiversity is becoming increasingly likely, and a severe reduction of many essential services to human societies as several 'tipping points' are approached. Many economies, however, remain blind to the huge value of the diversity of animals, plants and other life-forms and their role in healthy and functioning ecosystems from forests and freshwaters to soils, oceans and even the atmosphere, observes Dr. Steiner.

Now we need a new vision for biological diversity for a healthy planet and a sustainable future for humankind. In this paper, from the perspective of complexity green criminology, the underlying causes or indirect drivers of biodiversity loss, such as land-based pollutions, destructive fishing practices, patterns of consumptions, harmful subsidies etc., are addressed, and urgent and effective actions to reduce the multiple pressures being imposed on biodiversity are suggested.

2 What does biodiversity mean for us?

2.1 Ecosystem services and biodiversity loss

Biodiversity and ecosystems deliver crucial services to humankind – from food security to keeping our waters clean, buffering against extreme weather, providing medicines to recreation and adding to the foundation of human culture. Together these services have been estimated to be worth over 21–72 trillion USD every year – comparable to the World Gross National Income of 58 trillion USD in 2008.

Human society is however living well beyond the carrying capacity of the planet and currently over 60% of ecosystem services and their biodiversity are degrading, compromising sustainability, well being, health and security. Environmental degradation is augmenting the impact of natural disasters such as floods, droughts and

flash floods affecting 270 million people annually and killing some 124,000 people worldwide every year, 85% in Asia, and is, in some cases, even a primary cause of disasters. Degrading and polluted ecosystems are also a chief component in over 900 million lacking access to safe water. Poor management of activities on land and sea is further exacerbated by changing climatic conditions. In some scenarios loss of ecosystem services are depicted to result in up to 25% loss in the world's food production by 2050 along with hunger and spread of poverty in many regions.

2.2 Ecosystem services

Ecosystems and our natural environment constitute the platform upon which our entire existence is based. The services on which we depend include not only the air that we breathe and the joy of wildlife, but form the very basis of our food production, freshwater supply, natural filtering of pollution, buffers against pests and diseases and buffers against disasters such as floods, hurricanes and tsunamis. The Millennium Assessment (2005) described four categories of services, provisioning, regulating, supporting and cultural.

An Ecosystem is the dynamic complex of plant, animal and micro-organism communities and the nonliving environment interacting as a functional unit. It assumes that people are an integral part of ecosystems (MA, 2005). Ecosystem Services are the benefits that people obtain from ecosystems. They can be described as provisioning services (e.g. food, water, timber); regulating services (e.g. regulation of climate, floods, disease, waste and water quality); cultural services (e.g. recreational, aesthetic and spiritual) and supporting services (e.g. soil formation, photosynthesis and nutrient cycling) (MA, 2005).

Ecosystems ensure pollination, so crucial for agricultural production (Allenwardell *et al*., *et al*., 1998; Brown and Paxton, 2009; Jaffe *et al*., 2010), estimated at 153 billion USD in 2005 (Gallai *et al*., 2009) and it includes supply of water not only for irrigation and household use, but also for cooling in industrial processes, dilution of toxic substances and a transportation route (UNEP, 2010). It is also critical to health, not only through water supply and quality and through natural filtering of wastewater (UNEP, 2010). 80 % of people in developing countries rely on traditional plant-based medicines for basic healthcare (Farnsworth *et al*., 1985) and three-quarters of the world's top-selling prescription drugs include ingredients derived from plant extracts" (Masood, 2005), providing a string of services from rich to poor alike, but with particular value to the impoverished (Sodhi *et al*., 2010; UNEP, 2009).

Pest control is another key ecosystem service underpinned by biodiversity; it seems

to be greatly determined by the abundance of natural enemies present to counter the pest species involved, such as in coffee production (Batchelor *et al*., 2005; Johnson *et al*., 2010). Although biological systems are complex, improved pest control is often founded on a diversity of natural predators, and non-crop habitats are fundamental for the survival and presence of these biological control agents (predators, parasitoids) (Zhang *et al*. 2007). Landscape diversity or complexity, and proximity to semi-natural habitats tends to produce a greater abundance and species richness of natural enemies (Balmford *et al*. 2008, Bianchi *et al*. 2006; Kremen & Chaplin-Kramer 2007; Tscharntke *et al*. 2007).

Global change will alter the supply of ecosystem services thatare vital for human well-being (Schroter *et al*., 2005). Without functioning natural ecosystems, water supply for the world's food production would collapse, not only causing economic collapse and crisis in the entire financial system, it would also endanger health and lives of billions, and, hence, ultimately our survival (UNEP, 2009). The economic value of these ecosystem services were estimated at 16–54 trillion USD annually already in 1997 or corresponding to ca. 21–72 trillion USD in 2008 (CPI/inflation adjusted) compared to an estimated World Gross National Income (Atlas method, Worldbank) in 2008 of 58 trillion USD (Costanza *et al*., 1997). (N.B. Please note that there is substantial uncertainty with regard to these numbers. Updated figures are expected to be available by 2010/11).

At the same time, almost one third of the worlds ecosystems has been transformed or destroyed, and another third heavily fragmented and disturbed, and the last third already suffering from invasive species and pollution (UNEP, 2001; www.globio.info). Over 60% of the ecosystems services are considered degraded (MA, 2005). The big five human threats to the environment in the form of 1) habitat loss and fragmentation; 2) unsustainable harvest; 3) pollution; 4) climate change; and 5) introduction of exotic invasive species, are combined or individually rapidly not only destroying and degrading our ecosystems, they are also depleting and ruining the very services from them upon which we base our health and prosperity.

2.3 Global land-use change and biodiversity loss

Modern agricultural methods and technologies brought spectacular increases in food production, but are also a primary cause of habitat loss and ecosystem destruction (Tilman *et al*., 2002). Clearance for cropland or permanent pasture has already reduced the extent of natural habitats on agriculturally usable land by more than 50% (Green *et al* 2005), and much of the rest has been altered by temporary grazing (Groombridge and

Jenkins, 2002). Habitat modification already affects more than 80% of globally threatened mammals, birds and plants (Groombridge and Jenkins, 2002), with implications for ecosystem services and human well-being. Of the world's land, coastal and ocean area, only 13%, 6% and less than 1%, respectively, are within protected areas (WDPA, 2010).

3 Environmental crime

3.1 Environmental crime matters

The indicators of environmental crime are evident in many areas of international development activities. Significant global threats, including the challenges addressed through the Millennium Development Goals (MDGs) are connected to, and exacerbated by, environmental crime, "affecting development, peace, security and human rights". These issues, some of which have been on the table for many years, are slowly starting to be addressed and only now are enforcement agencies worldwide beginning to recognize the role of organized criminal networks in environmental crime. Increasingly, illegal logging and wildlife trafficking are driven by organized groups who exploit natural resources and destroy habitats: robbing communities of their livelihoods, compromising the wider economy and further endangering threatened species and ecosystems (Banks et al., p.2).

3.2 Global impact of environmental crime

As we destroy the Earth's protection from the sun through the illegal use of ozone-depleting substances, more damaging ultra violet light hits the Earth's surface, increasing the risk of skin disease and decreasing plant productivity. Natural disasters are occurring with increasing frequency, and with growing populations the impact and consequences are greater than ever before. The impact of such disasters would be less severe were it not for the felling of forests resulting in flooding and landslides; and the removal of mangroves for development means there is no longer any natural protection for coastal areas against erosion or storms. Global warming also leads to increased sea levels and associated flooding. Increasing demands for threatened flora and fauna can lead to the extinction of species, and destruction of habitat results in some species disappearing before they have even been discovered. Furthermore, environmental crime in the forestry sector has been identified as a major contributor to climate change, perhaps the world's most pressing security and economic challenge (Banks et al., p.3).

3.3 Millennium development goals --- fighting transnational crime

If the international community is to eradicate extreme poverty and hunger (Goal 1), then immediate consideration must be given to the long-term effects of deforestation, unsustainable poaching and climate change upon communities and livelihoods through loss of habitat for dwelling, livestock farming and agriculture, not to mention the increasing likelihood of natural disasters. The effects of loss of biodiversity from environmental crime can not be overstated. The global impact of direct killing for trade of often endangered species, or indirectly through loss of habitat – has a knock-on effect through species extinction, increased conflict between communities and wildlife, and loss of potential for communities to benefit from wildlife from areas such as tourism.

3.4 Case studies

3.4.1 Illegal logging

Serious organized crime in the forestry and timber industries is one of the most pressing environmental issues facing the global community. Driven by the low risks and high profits of a largely unregulated international market for cheap timber and wood products, illegal logging is threatening precious forests from the Amazon, through West and Central Africa, to East Asia. Illegal logging has dire consequences stretching far beyond the locus delicti of the crime. It threatens biodiversity, contributes to environmental catastrophes like flooding and forest fires, and is directly-linked to climate change as around one fifth of global greenhouse gas emissions are linked to forest loss.

It also impoverishes forest-dependent communities – it is estimated that illegal logging costs developing countries up to $15 billion a year in lost revenue and taxes (Banks et al., p.6).

3.4.2 Wildlife crime

It is seven years since the United Nations General Assembly declared the illicit trade in flora and fauna a form of serious transnational organized crime. Yet many countries affected by wildlife crime have been slow to invest in an appropriate enforcement response to identify and apprehend the key individuals who control the trade. Typically, wildlife crime is seen as a low priority for the professional enforcement community. However, the high profit - low risk (of being detected, apprehended and convicted), nature of wildlife crime makes it attractive and the proceeds of wildlife crime may even be used to finance other forms of serious crime. This alone should stimulate agencies that are concerned with socio-economic stability, security, law and order to be more

engaged in stopping wildlife crime. Aside from the loss of the endangered species that are targeted for their body parts, the communities that live around them are also robbed of a potential source of income through wildlife tourism. Wildlife crime therefore undermines global efforts to alleviate poverty and achieve the Millennium Development Goals (Banks et al., p.10).

3.4.3 Smuggling ozone-depleting chemicals

All life on Earth is dependent upon the ozone layer, a thin layer of gas in the upper atmosphere, which shields the Earth's surface from harmful solar ultraviolet radiation (UV). Severe depletion of the ozone layer is due to human activity introducing artificially high quantities of chlorine, bromine and other ozone depleting substances (ODS) into the stratosphere, where these chemicals destroy ozone molecules. Widely used chemical compounds are to blame – especially chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) used as refrigerants and halons used as fire suppressants. Increased exposure to UV directly impacts human health. Effects include suppression of the immune system, photo-aging of the skin, cataracts and skin cancer. Every year there are between two and three million new cases of non-melanoma skin cancers globally, with an estimated 66,000 annual deaths from various types of skin cancer. Children are most at risk from the damaging effects of UV radiation. It is not just humans that suffer the damaging effects of UV radiation: plants and ecosystems are also at risk. Research shows that UV-B impairs the reproductive capacity and early developmental stages of aquatic organisms.28 Increased exposure to UV light in terrestrial plants results in a reduction in height, decreased shoot mass, and a reduction in foliage area (Banks et al., pp.14-15).

3.4.4 Illicit trade in ivory

Illicit trade in ivory constitutes a form of serious trans-national organized crime (TOC) and the infamous 'Singapore Seizure' continue to illustrate the many challenges facing law enforcement agencies in tackling such networks. The international trade in elephant ivory has been banned since 1989. However, in June 2002, 532 elephant tusks and over 40,000 traditional Japanese name seals, weighing in at over 6.2 tonnes, were seized from a ship arriving in Singapore from South Africa en route to Japan (Banks et al., p.18).

The continued poaching of elephants is driven largely by market demand in Asia and Africa, although the United States and Europe also have illegal markets for ivory. This trade can be extremely lucrative: a kilo of ivory bought for US $15 in Africa can

fetch over US $850 in wealthy markets like Japan. With growing demand for ivory, the last six years has seen an increasing trend in the number of large seizures of illegal ivory making its way on to market places in the Far East, predominantly China: three tonnes seized in Shanghai, China in August 2003; six tones seized in the Philippines in 2005; almost 4 tonnes seized in Hong Kong in May 2006; over five tonnes seized in Taiwan in July 2006; 223 tusks seized in Dar es Salaam, Tanzania, in 2007 (Banks et al., p.19).

The seventh UN Millennium Development Goal (MDG) links environmental sustainability with sustainable development and poverty reduction.37 The illegal ivory trade undermines this goal by fuelling elephant poaching in developing countries, amounting to the theft of natural resources worth millions of dollars by international criminal gangs. Much of the ivory procured by the Singapore syndicate was sourced from Zambia's South Luangwa National Park (SLNP). Besides damaging the ecological biodiversity of the park, poaching on such a scale poses a threat to Zambia's budding tourism industry. As in many developing African countries, wildlife tourism in Zambia makes a crucial contribution to national GDP (Banks et al., p.19).

4 Current status and trends of biodiversity

4.1 Species populations and extinction risks

The population of wild vertebrate species fell by an average of nearly one- third (31%) globally between 1970 and 2006, with the decline especially severe in the tropics (59%) and in freshwater ecosystems (41%) (Secretariat of the Convention on Biological Diversity 2010, p.24).

Species in all groups with known trends are, on average, being driven closer to extinction, with amphibians facing the greatest risk and warm water reef-building corals showing the most rapid deterioration in status. Among selected vertebrate, invertebrate and plant groups, between 12% and 55% of species are currently threatened with extinction. Species of birds and mammals used for food and medicine are on average facing a greater extinction risk than those not used for such purposes. Preliminary assessments suggest that 23% of plant species are threatened (Secretariat of the Convention on Biological Diversity 2010, p.26).

4.2 Terrestrial ecosystems

Tropical forests continue to be lost at a rapid rate, although deforestation has recently slowed in some countries. Net loss of forests has slowed substantially in the past decade, largely due to forest expansion in temperate regions (Secretariat of the

Convention on Biological Diversity 2010, p.32).

Savannas and grasslands, while less well documented, have also suffered severe declines (Secretariat of the Convention on Biological Diversity 2010, p.34).

Abandonment of traditional agricultural practices may cause loss of cultural landscapes and associated biodiversity (Secretariat of the Convention on Biological Diversity 2010, p.35).

Terrestrial habitats have become highly fragmented, threatening the viability of species and their ability to adapt to climate change (Secretariat of the Convention on Biological Diversity 2010, p.36).

One-quarter of the world's land is becoming degraded (Secretariat of the Convention on Biological Diversity 2010, p.36).

Despite more than 12 per cent of land now being covered by protected areas, nearly half (44%) of terrestrial eco-regions fall below 10 per cent protection, and many of the most critical sites for biodiversity lie outside protected areas. Of those protected areas where effectiveness of management has been assessed, 13% were judged to be clearly inadequate, while more than one fifth demonstrated sound management, and the remainder were classed as "basic" (Secretariat of the Convention on Biological Diversity 2010, p.36).

Indigenous and local communities play a significant role in conserving very substantial areas of high biodiversity and cultural value (Secretariat of the Convention on Biological Diversity 2010, p.40).

4.3 Inland water ecosystems

Inland water ecosystems have been dramatically altered in recent decades. Wetlands throughout the world have been and continue to be lost at a rapid rate. Water quality shows variable trends, with improvements in some regions and river basins being offset by serious pollution in many densely-populated areas (Secretariat of the Convention on Biological Diversity 2010, p.41).

Of 292 large river systems, two-thirds have become moderately or highly fragmented by dams and reservoirs. Inland water ecosystems are often poorly served by the terrestrial protected areas network, which rarely takes account of upstream and downstream impacts. Governments are reporting increased concern about the ecological condition of wetland sites of international importance (Ramsar sites) (Secretariat of the Convention on Biological Diversity 2010, p.43).

4.4 Marine and coastal ecosystems

Coastal habitats such as mangroves, seagrass beds, salt marshes and shellfish reefs continue to decline in extent, threatening highly valuable ecosystem services including the removal of significant quantities of carbon dioxide from the atmosphere; but there has been some slowing in the rate of loss of mangrove forests, except in Asia. Tropical coral reefs have suffered a significant global decline in biodiversity since the 1970s. Although the overall extent of living coral cover has remained roughly in balance since the 1980s, it has not recovered to earlier levels. Even where local recovery has occurred, there is evidence that the new reef structures are more uniform and less diverse than the ones they replaced (Secretariat of the Convention on Biological Diversity 2010, p.46).

There are increasing grounds for concern about the condition and trends of biodiversity in deepwater habitats, although data are still scarce. About 80 percent of the world marine fish stocks for which assessment information is available are fully exploited or overexploited. While the extent of marine protected areas has grown significantly, a small proportion (less than a fifth) of marine ecoregions meet the target of having at least 10% of their area protected(Secretariat of the Convention on Biological Diversity 2010, pp.47-49) .

4.5 Genetic diversity

Genetic diversity is being lost in natural ecosystems and in systems of crop and livestock production. Important progress is being made to conserve plant genetic diversity, especially using ex situ seed banks. Standardized and high-output systems of animal husbandry have led to an erosion of the genetic diversity of livestock. At least one-fifth of livestock breeds are at risk of extinction. The availability of genetic resources better able to support future livelihoods from livestock may be compromised (Secretariat of the Convention on Biological Diversity 2010, p.51).

5 Current pressures on biodiversity

The persistence and in some cases intensification of the five principal pressures on biodiversity provide more evidence that the rate of biodiversity loss is not being significantly reduced. The overwhelming majority of governments reporting to the CBD cite these pressures or direct drivers as affecting biodiversity in their countries (Secretariat of the Convention on Biological Diversity 2010, p.55).

* Habitat loss and degradation
* Climate change
* Excessive nutrient load and other forms of pollution

* Over-exploitation and unsustainable use
* Invasive alien species

5.1 Habitat loss and degradation

Habitat loss and degradation create the biggest single source of pressure on biodiversity worldwide. For terrestrial ecosystems, habitat loss is largely accounted for by conversion of wild lands to agriculture, which now accounts for some 30% of land globally. In some areas, it has recently been partly driven by the demand for biofuels. For inland water ecosystems, habitat loss and degradation is largely accounted for by unsustainable water use and drainage for conversion to other land uses, such as agriculture and settlements. In coastal ecosystems, habitat loss is driven by a range of factors including some forms of mariculture, especially shrimp farms in the tropics where they have often replaced mangroves (Secretariat of the Convention on Biological Diversity 2010, p.55).

5.2 Climate change

Climate change is already having an impact on biodiversity, and is projected to become a progressively more significant threat in the coming decades. Loss of Arctic sea ice threatens biodiversity across an entire biome and beyond. The related pressure of ocean acidification, resulting from higher concentrations of carbon dioxide in the atmosphere, is also already being observed (Secretariat of the Convention on Biological Diversity 2010, p.56).

5.3 Pollution and nutrient load

Pollution from nutrients (nitrogen and phosphorous) and other sources is a continuing and growing threat to biodiversity in terrestrial, inland water and coastal ecosystems (Secretariat of the Convention on Biological Diversity 2010, p.59).

5.4 Overexploitation and unsustainable use

Overexploitation and destructive harvesting practices are at the heart of the threats being imposed on the world's biodiversity and ecosystems, and there has not been significant reduction in this pressure. Changes to fisheries management in some areas are leading to more sustainable practices, but most stocks still require reduced pressure in order to rebuild. Bushmeat hunting, which provides a significant proportion of protein for many rural households, appears to be taking place at unsustainable levels (Secretariat of the Convention on Biological Diversity 2010, p.62).

5.5 Invasive alien species

Invasive alien species continue to be a major threat to all types of ecosystems and species. There are no signs of a significant reduction of this pressure on biodiversity, and some indications that it is increasing. Intervention to control alien invasive species has been successful in particular cases, but it is outweighed by the threat to biodiversity from new invasions (Secretariat of the Convention on Biological Diversity 2010, p.64).

5.6 Combined pressures and underlying causes of biodiversity loss

The direct drivers of biodiversity loss act together to create multiple pressures on biodiversity and ecosystems. Efforts to reduce direct pressures are challenged by the deep-rooted underlying causes or indirect drivers that determine the demand for natural resources and are much more difficult to control. The ecological footprint of humanity exceeds the biological capacity of the Earth by a wider margin than at the time the 2010 target was agreed (Secretariat of the Convention on Biological Diversity 2010, p.66).

The trends from available indicators suggest that the state of biodiversity is declining, the pressures upon it are increasing, and the benefits derived by humans from biodiversity are diminishing, but that the responses to address its loss are increasing. The overall message from these indicators is that despite the many efforts taken around the world to conserve biodiversity and use it sustainably, responses so far have not been adequate to address the scale of biodiversity loss or reduce the pressure (Secretariat of the Convention on Biological Diversity 2010, p.67).

6 Complex green criminology and biodiversity loss

6.1 Nonlinear perception of biodiversity and its loss

Continuing species extinctions far above the historic rate, loss of habitats and changes in the distribution and abundance of species are projected throughout this century. There is a high risk of dramatic biodiversity loss and accompanying degradation of a broad range of ecosystem services if the Earth system is pushed beyond certain thresholds or tipping points. The loss of such services is likely to impact the poor first and most severely, as they tend to be most directly dependent on their immediate environments; but all societies will be impacted. There is greater potential than was recognized in earlier assessments to address both climate change and rising food demand without further widespread loss of habitats (Secretariat of the Convention on Biological Diversity 2010, p.71).

The results of the Global Biodiversity Outlook 3 pay particular attention to the relationship between biodiversity change and its impacts on human societies. In addition to the analysis of existing models and scenarios, a new assessment was carried out of potential "tipping points" that could lead to large, rapid and potentially irreversible changes. The analysis reached four principal conclusions:

a) Projections of the impact of global change on biodiversity show continuing and often accelerating species extinctions, loss of natural habitat, and changes in the distribution and abundance of species, species groups and biomes over the 21st century.

b) There are widespread thresholds, amplifying feedbacks and time-lagged effects leading to "tipping points", or abrupt shifts in the state of biodiversity and ecosystems. This makes the impacts of global change on biodiversity hard to predict, difficult to control once they begin, and slow, expensive or impossible to reverse once they have occurred.

c) Degradation of the services provided to human societies by functioning ecosystems are often more closely related to changes in the abundance and distribution of dominant or keystone species, rather than to global extinctions; even moderate biodiversity change globally can result in disproportionate changes for some groups of species (for example top predators) that have a strong influence on ecosystem services.

d) Biodiversity and ecosystem changes could be prevented, significantly reduced or even reversed (while species extinctions cannot be reversed, diversity of ecosystems can be restored) if strong action is applied urgently, comprehensively and appropriately, at international, national and local levels. This action must focus on addressing the direct and indirect factors driving biodiversity loss, and must adapt to changing knowledge and conditions (Secretariat of the Convention on Biological Diversity 2010, p.71).

6.2 Towards a strategy for reducing biodiversity loss

Well-targeted policies focusing on critical areas, species and ecosystem services can help to avoid the most dangerous impacts on people and societies from biodiversity loss in the near-term future, which it will be extremely challenging to avoid. In the longer term, biodiversity loss may be halted and then reversed, if urgent, concerted and effective action is applied in support of an agreed longterm vision. The 2010 review of the strategic plan for the Convention on Biological Diversity provides an opportunity to define such a vision and set time-bound targets to stimulate the action required to achieve it.

We can no longer see the continued loss of biodiversity as an issue separate from the core concerns of society: to tackle poverty, to improve the health, prosperity and

security of present and future generations, and to deal with climate change. Each of those objectives is undermined by current trends in the state of our ecosystems, and each will be greatly strengthened if we finally give biodiversity the priority it deserves (Secretariat of the Convention on Biological Diversity 2010, p.87).

7 Conclusions: New concept 'crimes against biodiversity'

The pressures or drivers do not act in isolation on biodiversity and ecosystems, but frequently, with one pressure exacerbating the impacts of another. For example:

* Fragmentation of habitats reduces the capacity of species to adapt to climate change, by limiting the possibilities of migration to areas with more suitable conditions.

* Pollution, overfishing, climate change and ocean acidification all combine to weaken the resilience of coral reefs and increase the tendency for them to shift to algae-dominated states with massive loss of biodiversity.

* Increased levels of nutrients combined with the presence of invasive alien species can promote the growth of hardy plants at the expense of native species. Climate change can further exacerbate the problem by making more habitats suitable for invasive species.

* Sea level rise caused by climate change combines with physical alteration of coastal habitats, accelerating change to coastal biodiversity and associated loss of ecosystem services. 2010 biodiversity target was agreed in 2002.

These pressures and drivers of biodiversity loss create multiple pressures on biodiversity and ecosystems. Facing the criticality of biodiversity, we have to make and develop a new concept 'crimes against biodiversity'.

Note:

1) This paper is a part of results of "the research on global environmental crises and complexity green criminology", Grant-in-Aid of Scientific Research (c) 2008-2011, and is based on the presentation at the 10th Annual Conference of European Society of Criminology, Liege, Belgium, 8-11 September, 2010.

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Floating Space Debris contaminating the Beach of Earth:
Toward the time/space theory for complexity green criminology

1 Introduction

Environmental harms/crimes have diverse aspects, phases and dimensions. On the one hand, we find national, intra-/inter-regional, and trans-regional phenomenon. It is necessary to view environmental harms/crimes from a trans-spatial perspective. On the other hand, learning lots of things from ruins and remnants of past environmental destructions, we are apprehensive that environmental catastrophes might occur in the near future. It is necessary to view past/present/future environmental harms/crimes from a time-series perspective. Finally, a way of fission and fusion of time/space theory for complexity green criminology will be suggested.

2 Space junk has reached “tipping point”

The amount of debris orbiting the Earth has reached “a tipping point” for collisions, which would in turn generate more of the debris that threatens astronauts and satellites. We need a new strategic plan for mitigating the hazards posed by spent rocket bodies, discarded satellites and thousands of other pieces of junk flying around the planet at speed of 17,500 miles per hour.

The problem of space debris is similar to a host of other environmental problems and public concerns characterized by possibly significant differences between the short- and long-run damage accruing to society.
Damage related to atmospheric concentrations of greenhouse gases, storage of nuclear waste and long-lived pharmaceutical residue in underground aquifers. Each has small short-run effects but, if left unaddressed, will have much larger impacts on society in the future.

3 ESA Space Debris Office

Since the mid-1980s, ESA (European Space Agency) has been active in all relevant research, technology and operational aspects related to space debris. Agency expertise is mainly concentrated at the European Space Operations Center (ESA/ESOC), Darmstadt,

Germany, and the European Space Research and Technology Center (ESA/ESTEC), Noordwijk, The Netherlands.

The team at ESOC have developed long-standing experience in the area of:

- Rader and optical measurements and their simulation
- Development of space debris and meteoroid environment and risk assessment model
- Analysis of debris mitigation measures and their effectiveness for long-term environmental stability
- In-orbit collision risk assessments
- Re-entry safety analyses
- Space debris database issues

4 50 years of space activity

With increasing space activities, a new and unexpected hazard started to emerge: space debris. In almost 50 years of space activities, more than 4800 launches have placed some 6000 satellites into orbit, of which only a minor fraction – about 800 – are still operational today. Besides this large amount of intact space hardware, with a total mass of about 5500 tonnes, several additional objects are known to orbit the Earth. More than 12,000 in total are regularly tracked by the US Space Surveillance Network and maintained in their catalogue, which covers objects larger than approximately 5 to 10cm in low Earth orbit (LEO) and 30cm to 1m at geostationary altitudes (GEO).

Only 6 percent of the catalogued orbit population are operational space craft, while 38 percent can be attributed to decommissioned satellites, spent upper stages and mission-related objects (launch adaptors, lens covers, etc.).
The remaining 56 percent originate from more than 200 in-orbit fragmentations which have been recorded since 1961. Except for a few collisions (less than 10 accidental and intentional events), the majority of the 200 break-ups ware explosions of spacecraft and upper stages.

These are assumed to have generated a population of objects larger than 1cm on the order of 600, 000. Only near sizes of 0.1mm to 1mm may be the sporadic flux from meteoroids, which prevail over man-made debris.
The main cause of in-orbit explosions is related to residual fuel that remains in tanks or fuel lines once a rocket stage or satellite is discarded in Earth orbit. Over time, the harsh

space environment can deteriorate the mechanical integrity of external and internal parts, leading to leaks and/or mixing of fuel components, which could trigger self-ignition.

5 Anti-satellite test: 25 percent more debris

The resulting explosion can destroy the source object and spread its mass across numerous fragments with a wide spectrum of masses and imparted velocities. Besides such accidental break-ups, spacecraft interceptions by surface-launched missiles have been a major contributor in the recent past.
The Chinese Feng-Yun 1C engagement in January 2007 alone increased the trackable space object population by 25

6 Other sources of debris fragments

6.1 First-ever in-orbit collision

The first-ever accidental in-orbit collision between two satellites occurred 10 February 2009, at 776km altitude above Siberia. An American privately owned communication satellite, Iridium 33, and a Russian military satellite, Kosmos 2251, collided at a relative speed of 11.7km/second. Both were destroyed, and a large amount of debris generated.
Satellites launched into LEO are continuously exposed to aerodynamic forces from the tenuous upper reaches of the Earth's atmosphere. Depending on the altitude, after a few weeks, years or even centuries, this resistance will have decelerated the satellite sufficiently so that it re-enters into the atmosphere. At higher altitudes, i.e. above 800km, air drag becomes less effective and objects will remain in orbit for many decades.

6.2 "Kessler syndrome": debris growth

With today's annual launch rates of 60 to70 and with future break-ups continuing to occur at mean historic rates of four to five per year, the number of objects in space will steadily increase.
As a consequence of the rising object count, the probability for catastrophic collisions will also grow in a progressive manner (doubling the number of objects will increase the collision risk approximately four-fold).

As the debris population grows, first collisions will occur. Such collisions will start prevailing over the now-dominating explosions within a few decades from now. Ultimately, collision fragments will collide with collision fragments, until the entire population is ground to sub-critical sizes.
This self-sustained process, which is particularly critical for the LEO region, is known as the “Kessler syndrome”. It is a scenario that must be avoided by the timely application of space debris mitigation and remediation measures on an international scale.

7 Re-entry events

Everyday satellites, rocket stages or fragments thereof re-enter into the denser layers of the atmosphere, where they usually burn up. Shortly before re-entry, at about 120km altitude, space craft have velocities of typically 28,000km/hour.
In the last 10 minutes before reaching ground, the dens atmosphere starts to heat up and decelerate the spacecraft. In the case of very compact and massive spacecraft, and if a large amount of high-melting material is involved (e.g. stainless steel or titanium), fragments of the vehicle may reach the Earth’s surface.
Well-known examples of large-scale re-entry events were Skylab (74tonnes, July 1979), Salyut7/Kosmos1686 (40tonnes, February 1991) and Mir (135tonnes, March 2001). In such cases, up to 20 to 40 percent of the spacecraft mass may impact the surface.
ESA’s ATV (Automated Transport Vehicle) performed a controlled and safe re-entry into an uninhabited area in the South Pacific Ocean on 29 September 2008. The re-entry break-up process was monitored from two observation aircraft.

8 Re-entry prediction capability and risk control

For people and property on the ground, the hazards posed by re-entering spacecraft or debris are extremely small. So far, there has been only one reported injury and no fatality.
The controlled or uncontrolled re-entry of space systems is associated with a number of legal and safety aspects that must be considered. This risk due to re-entries can be determined through analysis of surviving fragments (if any), their dispersion across a ground swath, and the resulting casualty risk for the underlying ground population distribution.

Re-entry maneuvers can be optimized to control the impact footprint (ideally over

an ocean area), and thus maintain the casualty probability below an acceptable risk threshold (e.g. less than 1 in 10,000 for a single re-entry).

In the case of uncontrolled re-entries, the re-entry time window and impact footprint can be predicted and monitored. The quality of this process can be improved through tracking data and sophisticated orbit prediction tools. ESA has all necessary capabilities to provide analysis of both controlled and uncontrolled re-entries. This includes detailed simulations of the aero-thermal and structural break-up of satellites or orbital stages, the prediction of the orbit and attitude of each re-entry fragment, the identification of objects reaching ground and the analysis of associated risk potentials for the population in the entry ground swath.

9 European experts follow satellite reentry in 2011

ESA closely monitored the reentry on 24 September 2011 of the NASA's non-operational Upper Atmosphere Research Satellite (UARS), observatory satellite. The Agency's Space Debris Office worked with NASA and international partners known as the Inter-Agency Debris Coordination Committee (IADC) in a coordinated prediction and risk-assessment exercise. The precise reentry time and location of debris impacts from the 5.6-tonne satellite have not been determined. No injuries or damage have been reported.

10 Future developments of European observation capacity

In 2009, ESA launched the Space Situational Awareness Preparatory Programme (SSA-PP), aiming to increase Europe's capabilities to detect, predict and assess the risk to life and property due to man-made space objects, reentries, on-orbit collisions, potential impacts of Near Earth Objects, and the effects of space weather.
A longer warning time and more accurate predictions will assist civil authorities to react in the most appropriate manner, protecting people and property on Earth.

10 Scanning the skies for debris hazards

The first European Space Surveillance Conference (ESS2011) was held 7-9 June 2011 in Madrid, Spain. Over 150 global experts met at an ESA-organized conference to share the latest research findings on space debris, surveillance technologies, orbital

hazard detection and satellite safety. The conference spotlighted ESA's SSA programme, now in the preliminary phase, which aims to put in place a 'three-legged' system to warn of hazards posed by orbital debris, space weather and natural objects like asteroids that may strike Earth.

11 Complex engineering and scientific challenge

A new generation of software was recently implemented to warn when satellites could be hit by orbiting debris. Debris surveillance is a complex engineering and scientific challenge in part due to the fact that even a tiny piece of debris – just 1 centimeter across – can seriously damage or even destroy a functioning satellite if it impacts at orbital velocities.

Today, Europe cannot scan as much of space as necessary to provide comprehensive debris warning services to private and public spacecraft operators, like those flying telecommunication, climate and weather satellites. The design for next-generation debris surveillance and tracking systems will be proposed at the end of the current preliminary phase in 2012.

12 Space Debris Mitigation Guidelines

As the population of debris continues grow, the probability of collisions that could lead to potential damage will consequently increase. In addition, there is also the risk of damage on the ground, if debris survives Earth's atmospheric reentry. The prompt implementation of appropriate debris mitigation measures is therefore considered a prudent and necessary step towards preserving the outer space environment for future generations.

A set of mitigation guidelines has been developed by the Inter-Agency Space Debris Coordination Committee (IADC), reflecting the fundamental mitigation elements of a series of existing practices, standards, codes and handbooks developed by a number of national and international organizations.

The following guidelines should be considered for mission planning, design, manufacture and operational (launch, mission and disposal) phases of spacecraft and launch vehicle orbital stages:

Gl 1: Limit debris released during normal operations

Gl 2: Minimize the potential for break ups during operational phases
Gl 3: Limit the probability of accidental collision in orbit
Gl 4: Avois international destruction and other harmful activities
Gl 5: Minimize potential for post-mission break-ups resulting from stored energy
Gl 6: Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low-Earth orbit (LEO) region after the end of their mission
Gl 7: Limit the long-term interference of spacecraft and launch vehicle orbital stages with geosyncronous Earth orbit (GEO) region after the end of their mission

13 Conclusions

The hazard posed by space debris is becoming of increased concern to the scientific and commercial users of space. Apart from observable, cataloged objects, there is a much more abundant population of hazardous space debris which cannot be tracked. The special distribution and dynamics of the resulting population can be expressed in mathematical models, which can be used to determine the collision risk for a given space mission. The risk on orbit can be reduced by different debris mitigation measures, the effectiveness of which can be tested in long-term projections of the debris environment. Other mitigation measures can be defined for the risk reduction due to atmospheric reentry and ground impact. The space environment must be kept as clean as possible and at a safe level for future generations.

Note:
1) This paper is based on the paper titled ‘Fission and Fusion of time/space theory for complexity green criminology’, and presented at the 63rd Annual Meeting of American Society of Criminology, Washington, D.C., November 16-19, 2011.

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Toward a Time-and-Space Theory for Complex Dynamic Green Criminology: Complexity, Contingency and Nonlinearity of Human-Environment Interactions

1 Introduction

Today we face environmental problems such as deforestation, over-fishing, soil erosion, global climate change, over-utilization of fresh water supplies, exhaustion of energy reserves, and accumulation of toxics. These problems may threaten our existence over the coming decades or centuries. It is said that some of ancient collapses have been self-inflicted ecological suicides, resulting from inadvertent human impacts on environment which are similar to impacts causing problems that we face today. In order to understand collapses of ancient societies and a possibility of collapses of present/future societies, it is necessary to look at the impacts of humans on their environment not only globally but also historically, because they are usually more complicated with space and time factors.

In this research, first, we follow the historical analysis by Jared Diamond on how environmental destructions or degradations affect collapses of ancient civilization. Second, we examine the critical discussion on Collapse by Patricia A. McAnany and Norman Yoffee. Third, we consider suggestions by Rob White in transnational environmental crime, and widen the perspective to 'transnational and trans-generational environmental crime'. Fourth, we analyze relationships of humane and environment, and extract their features: complexity, contingency and nonlinearity. Finally, based on 'complexity green criminology', a future perspective, a new perspective of environmental crime research through time-and-space unified theory, is suggested.

2 Collapse: How Societies Choose to Fail or Succeed

2.1 Collapses, past and present

Diamond explains that the processes through which past societies have undermined themselves by damaging their environments fall into eight categories, whose relative importance differs from case to case: deforestation and habitat destruction, soil problems (erosion, salinization, and soil fertility losses), water management problems, overhunting, overfishing, effects of introduced species on native species, human population growth, and increased per capita impact of people. The environmental problems facing us today include the same eight that undermined past societies, plus

four new ones: human-caused climate change, build-up of toxic chemicals in the environment, energy shortages, and full human utilization of the Earth's photosynthetic capacity. It is claimed that most of these 12 threats will become globally critical within the next few decades (Diamond 2006, pp.6-7).

2.2 The most serious problems

He analyzes environmental problems that the most serious environmental problems facing past and present societies fall into a dozen groups. Eight of the 12 were significant already in the past, while four (energy, the photosynthetic ceiling, toxic chemicals, and atmospheric changes) became serious only recently. The first four of the 12 consist of destruction or losses of natural resources (destruction or loss of natural habitats, wild food sources, biological diversity, and soil); the next three involve ceilings on natural resources (ceilings on energy, freshwater, and photosynthetic capacity); the three after that consist of harmful things that we produce or move around (toxic chemicals, alien species, and atmospheric gases); and the last two are population issues (increase in human population). These 12 sets of problem are linked: one problem exacerbates another or makes its solution more difficult. Our world society is presently on a non-sustainable course, and any of our 12 problems of non-sustainability would suffice to limit our lifestyle within the next several decades. They are like time bombs with fuses of less than 50 years (Diamond 2006, pp.486-496, 498).

2.3 What can be learned from the ancient collapses?

Diamond sets some questions and answers them. Why did these ancient civilizations abandon their cities after building them with such great effort? Why these ancient collapses? Why is it that some societies collapsed while others did not collapse? These questions are relevant to the environmental problems that we face today: problems such as deforestation, the impending end of the tropical rainforests, over-fishing, soil erosion, soil desalinization, global climate change, full utilization of the world's fresh water supplies, exhaustion of energy reserves, accumulation of toxics in water, food and soil, increase of the world's population. These problems threaten our existence over the coming decades (Diamond).

He continues that what can the past teach us about why some societies are more unstable than others, and about how some societies have managed to overcome their environmental problems? Can we extract from the past any useful guidance that will help us in the coming decades? There is overwhelming recent evidence from archaeology and other disciplines that some of these mystery collapses have been

self-inflicted ecological suicides, resulting from inadvertent human impacts on the environment, impacts similar to the impacts causing the problems that we face today. Even though these past societies like the Easter Islanders had far fewer people, and were packing far less potent destructive practices than we do today. It turns out that these ancient collapses pose a very complicated problem. It is not just that all these societies collapsed, some societies have gone on for thousands of years without any signs of collapse, such as Japan. What is it then that made some societies weaken and other societies robust? It is also a complicated problem because the collapses usually prove to be multi-factorial (Diamond).

2.4 Understanding the collapses of societies

He insists that, in order to understand the collapses of societies, we need a checklist of five things. Usually several of them are operating, but in some cases all five of these things are operating. The first of these factors is environmental damage, inadvertent damage to the environment through means such as deforestation, soil erosion, desalinization, over hunting, etc. The second item is climate change, such as cooling or increased aridity. People can hammer away at their environment and get away with it as long as the climate is benign, warm, wet, and the people are likely to get in trouble when the climate turns against them, getting colder or drier. So climate change and human environmental impact interact. The third factor is a society's relations with hostile neighbours. Most societies have chronic hostile relations with some of their neighbours, and they are most likely to fail to hold off the hostile neighbours when the society itself gets weakened for environmental or any other reasons, such as the fall of the Western Roman Empire. Relations with hostiles interact with environmental damage and climate change. The fourth is relations with friendly neighbours. If one of those friendly societies runs into environmental problems and collapses for environmental reasons, that collapse may then drag down their trade partners. The fifth is people's cultural response. Why is it that people failed to perceive the problems developing around them, or if they perceived them, why did they fail to solve the problems? Why did some peoples perceive and recognize their problems and others not? (Diamond)

He mentions four examples of past collapsed societies: First is Easter Island, which is the simplest case, the closest approximation to a collapse resulting purely from human environmental damage. The second case are the collapses of Henderson and Pitcairn Island in the Pacific, which were due to the combination of self-inflicted environmental damage, plus the loss of external trade due to the collapse of a friendly trade partner. The third is the Anasazi in the US south-west whose collapse was a

combination of environmental damage and climate change. The forth is the Greenland Norse who ended up all dead because of a combination of all five factors (Diamond).

3 Questioning Collapse 1: Human Resilience and Ecological Vulnerability

3.1 Why we question Collapse

In Collapse Diamond warns of real and potential environmental destruction in the present by arguing that past societies and cultures collapsed because they damaged their environments. McAnany et al. focus on several questions:

(1) Why do we portray ancient societies as successes or failures?

(2) How do we characterize people who live today in the aftermath of empires?

(3) How are urgent climatic and environmental issues today similar to those faced by our ancestors? Can we learn from the past? (McAnany et al., pp.4-5)

They answer that, certainly crises existed, political forms changed, and landscapes were altered, but rarely did societies collapsed in an absolute and apocalyptic sense. Even the examples of societal collapse often touted in the media (Rapa Nui (Easter Island), Norse Greenland, Puebloan U.S. Southwest, and Maya Lowlands) are also cases societal resilience when examined carefully. Today's worries about the future make our way into explanations of the past. Times of environmental woes beget theories of past environmental troubles. Historians and archaeologists, who are not immune to seeing the past through modern lenses, try to test the relevance of their ideas by looking for multiple lines of evidence that point to the same conclusion (McAnany et al., pp.5-7).

They argue that the notion that the present recapitulates the past is not necessarily true. How long human societies have possessed the technological ability to profoundly change and destroy their environment and bring down their societies? A formidable body of evidence suggests that the human ability to impact environment on a global scale is newfound and cannot be pushed back beyond the Industrial Revolution of the 1800s. Adopting a well-informed long view of humans have lived on the Earth can promote decision making and policy development that results in human survival and resilience rather than the reverse (McAnany et al., pp.7-8).

3.2 Choice- Determinism, Resilience and Social Change

They analyze that, in the Diamond's scenario, societies make the decisions that result in long-term success or failure. In societies that fail, leaders are selfish and advance schemes that endanger the ecological well-being of their community, polity, or

island. At the root of this thesis is the modern neoliberal theory of self-interested motivation as well as the assumption of unconstrained and rational choice. Many economists view the motivational assumptions of self-interest and rational choice theory as lacking explanatory power. When applied globally and into deep time, this theory has particular difficulties. Furthermore, there is no necessary linkage between a selfish decision made in the short term and adverse long-term consequences. Decision makers, however powerful, were not so powerful as to engineer their own environmental ruin (McAnany et al., pp.8-9).

They suggest their concept an important part of the "science of the long view" is the concept of resilience, or "the ability of a system to absorb disturbance and still retain its basic function and structure," albeit in altered form. Resilience means that some kinds of change, especially political change, can be quick and episodic, whereas other kinds of change, for example, changes in kinship structure and belief systems, can be slower moving. Also, both kinds and different paces of change can coexist. Although change is inevitable, and living through some kinds of change is difficult, painful, or even catastrophic, "collapse", in the sense of the end of a social order and its people, is a rare occurrence. Resilience is a more accurate term to describe the human response to extreme problems. Archaeologists, anthropologists, and historians are not fortune tellers or prophets, but the historical lessons of resilience may help us chart a course for the future (McAnany et al., pp.10-11).

3.3 Ecological vulnerabilities

They give our direction that environmental challenges (and crises) have posed risks to societies since humans began to domesticate their landscape shortly after the close of the last Ice Age about 10,000 years ago, and even earlier. Today we are profoundly concerned about the fragility of our ecosystem and wonder whether we are poised on the brink of an ecological calamity on a global scale. How can information from the past guide us through these perilous times? Societies modify their practices in response to perceived crises. But it is possible that investments made in response to recurrent crises of short duration may leave us vulnerable to unknown long-term cycles of risk that ultimately bring into play a cascade of unwelcome changes. The resilience of the larger social collective is endangered by such crises, which can originate from a host of sources, including climate change and political decision making. In any case, understanding ecological vulnerabilities, past and present, leads us to ask the right questions and take needed actions (McAnany et al., pp.11-12).

4 Questioning Collapse 2: Success or Failure, Survival or Collapse

4.1 Chosen variables: population numbers and complexity

MacAnany et al. continue their argument that, over the past 5,000 years and so, thousands of peoples and cultures have been obliterated, either biologically driven to extinction by violence and epidemics, or culturally and biologically assimilated into a larger and more powerful polity and culture. None of these were collapses, by Diamonds definition, because they did not involve drastic declines in numbers of complexity; they involved drastic cultural and political changes. If a people, a language, and a culture survive, as among the Maya, the Norse, or the Anasazi, is this a collapse? To Diamond it is, because either human numbers or societal complexity declined drastically. To others it is not, because something central survived, and the people involved made a prudent adjustment to changing circumstances, in effect migrating to avoid the worst. For Diamond numbers and complexity are all; for others, especially anthropologists perhaps, cultural survival in such forms as language, religion, or foodways trumps Diamond's chosen variables (McAnany et al., pp.336, 359).

They insist that, judgements of success or failure, survival or collapse, are often more difficult to make. Perspective and context matter. Can a society that survived a century be counted a success whereas one that lasted 450 years count as failure? Can one that responds to environmental stresses by migration be judged a failure whereas one that responds by conquering neighbouring lands, or enlisting resources from other continents, be judged a success? In Collapse, Diamond appears motivated by a deep concern for the environmental state of the earth. Diamond many times acknowledges uncertainties, especially with archaeological evidence. But he nevertheless has chosen to rally readers as best he can even when it leads him into intellectual difficulties (McAnany et al., p.360).

4.2 Other lenses: culture, politics and ecology

They argue that Diamond's laudable concern for the avoidance of collapse, for sustained survival, raises the question of what that might mean. To Diamond it apparently means the maintenance of levels of population and social complexity in a given place. But there are other ways to see it. One, which is of particular interest to many anthropologists, is the maintenance of a culture. In this view survival consists of maintenance whatever the preferred markers of a culture may be, such as language or religion. Another way to look at sustained survival is through a political lens. For some people what matters most is the survival of a specific polity, rather than a culture, or

certain levels of population and complexity. This is especially true in times and places where people identify, via nationalism or some other mechanism, with their state. A third way to look at sustained survival is through an ecological lens. With emergence of agriculture, which happened several times in several places but for the first time probably around 11,000 years ago, sustainability became a potential problem. All firming is a struggle against the depletion of soil nutrients (McAnany et al., pp.361-362).

Concerning the contemporary world and survival, they insist that the environmental problems that bedevil the world today are vastly different from those that beset Easter Island. They are different in scale. They do not readily lend themselves to solution via wise decisions by enlightened leaders, because they are all complicated, and many of them derive in large measure from the energy system that has gradually come to prevail over the past 200 years: a fossil energy system. Our ways are radically unsustainable (McAnany et al., pp.364-365).

5 Transnational Environmental Crimes

5.1 Interconnectedness, 'butterfly effect', and context

White explains that transnational environmental harm is a crime. One of the characteristics of the contemporary world is the interconnectedness of people, systems, and networks, a concept that is captured in notion of the 'butterfly effect'. What happens in one part of the world, no matter how small or seemingly trivial will have an impact, and sometimes a very large impact, in another part of the world. The fluttering of butterfly wings in the southern hemisphere can translate into hurricane force winds in the northern. We are all interconnected, in complex ways, for better and for worse. The local is indeed global in this worldwide system of networks and flows (White, p.1).

He continues that, to appreciate fully the nature of global environmental crime it is useful to consider the physical location of harm within particular geographical contexts. On the world map, it is possible to plot out a myriad different types of harms, some of which are common across the surface, others of which are specific to particular locales, regions and countries. Layer after layer of harm, present and potential, can be determined by, on the one hand, investigating ecological trends that involve degradation and destruction of environments (such as clear felling of forests) and, on the other, by considering existing documentation of specific types of environmental crime (such as illegal international trade in flora and fauna). The harms so described are interconnected and intertwined in various ways: the 'butterfly effect' is real in more ways than one.

What happens at the local level has consequences for those on the other side of the planet. What happens in any one place is thus intrinsically important to what happens worldwide (White, pp.10-11).

5.2 Three ways of transnational environmental crime research

He insists that there are certainly interesting complexities in undertaking the study of international or transnational crime. Consideration of scale and focus are implicit in the framing of research into transnational environmental crime. There are at least three different ways in which transnational research can be approached: global, comparative, and historical. The first approach focuses on globalization as a far-reaching process in which crime can be traced in its movements across the world and its presence documented in many different locales. The second approach has a comparative focus, with a concern to study particular countries and regions in relation to each other. The third approach is based upon historical appreciation of social change and social differences. It views trends and issues in terms of major epochs, such as the transitions from feudalism to capitalism, or the shift from competitive capitalism to global monopoly capitalism. It is important to track systemic changes over time, within and between different types of social formation (White, pp.15-17).

He continues that the researching of transnational environmental crime provides a useful illustration of how these approaches might be utilized and combined. After all, environmental harm crosses borders to incorporate all nation states on planet Earth (ozone depletion, global warming). Comparative analysis shows us where some of the 'weak links' are (failed states, states at war, civil unrest) and thus hot spots for particularly worrisome environmental problems (dumping of toxic waste). Historical studies can alert us to the ways in which 'growth states' churn up natural resources, but also how ecological consciousness can grow out of affluence and growing middle class (White, p.17).

5.3 New research way: 'horizon scanning'

He calls for the new way of research 'horison scanning' that the use and need for horizon scanning as an intellectual exercise and planning tool is related to the idea that many threats and opportunities are at present poorly recognized. Accordingly, a more systemic approach to identification and solution to issues is required rather than reliance upon ad hoc or reactive approaches. Horizon scanning can provide insight into risks (potential problems) and harms (actual problems). It provides a mechanism to discern where emerging threats (and positive opportunities) may arise and potential ways to

mitigate or adapt to these. In analysis of horizon issues a variety of concepts might be deployed. Certainly matters of time, space and scale are relevant. For example, risks and harms may be direct or indirect, and their consequences may be felt in the immediate or in the long term. Harm may be specific to local areas (threats to certain species), yet manifest as part of a general global pattern (an effect of wide-scale temperature changes affecting everywhere). Harm is central, but this may be non-intentional (a by-product of some other agenda) or premeditated (foreseen negative outcome) (White, pp.32-33).

He adds that there are several other concepts that are particularly relevant to horizon scanning. Three of these address matters of justice, past, present and future: environmental justice, ecological justice and species justice. Three of these look to the future: intergenerational equity, the precautionary principle, and transference over time. Collectively these concepts provide a values framework for assessing and analysing risks and harms as part of the exercise of looking over the horizon (White, p.33).

6 Complex-, Contingent-, Nonlinear Relationship of Human-Environment

6.1 Interaction of culture, climate, and environment

Yaeger and Hodell assess the interaction of culture, climate and environment that the collapse was undoubtedly a complex process structured by many different factors, of which climate change was important in many regions of the Maya lowlands. Demographic and environmental transformations such as population increase, deforestation, and topsoil erosion also influenced the collapse. To understand the role that climate and environmental change might have had, we must assess how such changes would have shaped people's options and decision-making in the Classic Period. The complex interactions among paleoclimate, environment, and culture could have led to the collapse (Yaeger et al., pp.197-198).

They insist that there is no evidence that climate change was any more of a "trigger" for the Terminal Classic transformation of Maya civilization than were population growth, interpolity conflict, soil erosion, and the other observable processes that began prior to or coeval with climate changes in various regions. One could argue that climate change is qualitatively different from these processes in that people cannot in most cases regulate its causes, but they certainly respond to adverse climate changes to mitigate their effects (Yaeger et al., pp.237-238).

As a conclusion they mention that the rich and rapidly growing body of available archaeological, environmental, and climatological data leads us to offer three criteria that any model of the Maya collapse should meet. First, it must conceptualize the

collapse not as a catastrophe or an event, but as a complex set of processes that were inherently social and cultural, and that transformed the demography, economy, and political organization of lowland Maya civilization over the course of several centuries. Second, it must include explicit discussion of the ways in which climate change affects the natural and cultural contexts that shape people's decisions, past and presents. Interdisciplinary research programs provide the diverse kinds of data we need to evaluate the interrelationships between climate change, the environment, and Maya civilization. Finally, these models must pay close attention to local climatic, environmental, and cultural conditions. The factors that led to the collapse of Maya polities and the abandonment of Maya sites during the Terminal Classic Period, as well as the processes of collapse themselves, varied significantly in time and space across the Maya lowlands (Yaeger et al., p.238).

6.2 Human-Environment Interactions

Dearing et al. analyse human-environment interactions that, in terms of human-environment interactions through time, much attention has been focused on well-documented case-studies, particularly those based on archaeological records that demonstrate societal collapse through vulnerability to climate change, environmental maladaptation or mixture of both. Drought, in particular, has been one of the factors contributing to major declines in civilizations as diverse as the Maya, Anasazi, Hohokum, Tiwanaku and prehistoric cultures in the Atacama and Andian Altiplano in the New World; likewise the Akkadian and Harrapan Empires, and groups in the east Mediterranean, the Sahara, South Africa and China in the Old World (Dearing et al., p.2).

They continue that, while studies do much to focus attention on the potentially catastrophic nature of social and environmental change, they do not necessarily provide relevant analogues for interactions between modern societies and their environment. Moreover, there are other lessons to be learned from past records about the long-term sustainability and management of ecosystems and services. We need to extend this scope to embrace the full spectrum of human-environment interactions. These include the demise of agriculturally marginal systems, but additionally include both histories of more subtle, adaptive and cumulative changes that provide the background to the majority of human-dominated landscapes and the natural variability of ecosystyems where or when human impact has been low (Dearing et al., p.2).

They explain that PAGES is a core project of the international geosphere-biosphere programme. In 2001, PAGES Focus 5, entitled 'Past Ecosystem Processes and

Human-Environment Interactions', was initiated in recognition of the need to move beyond the use of palaoenvironmental studies to reconstruct climate dynamics, and to enhance and coordinate long-term perspectives on terrestrial ecosystems that encompass the human dimension. The need was justified in different ways:

1. The complex relationships that exist between climate and human activities, lying at the heart of modern environmental concerns, are still poorly understood in terms of the role of human activities in generating climate change and the adaptability of human populations to future climate change.
2. The functioning of the majority of modern global ecosystems is in part contingent on a significant history of human impact, demanding that integrated strategies for preservation, conservation or sustainable management of ecosystem incorporate an understanding of long-term responses to climate and human activities.
3. The management and remediation of complex socio-environments increasingly demands the highest level of ecosystem understanding, which may require definition of targets in terms of pre-impact or postulated natural conditions.
4. A large number of researchers have been indirectly involved in Focus 5 science, but fragmented and often poorly coordinated research has not achieved its potentially high impact (Dearing et al., pp.2, 4).

They insist that the diversity of contemporary environmental problems, the unequal geographical distribution of projected human and climate impacts, and the wide range of scientific expertise therefore argued for a significant convergence of priorities and approaches. Thus Focus 5 was set up to promote the integrated use of environmental archives (e.g. sediments and tree-rings), archaeological data (e.g. habitation artefacts), documented histories (e.g. land use inventories), and instrumental records (e.g. meteorology, long-term ecosystem monitoring) to inform about the behaviour or terrestrial ecosystems within the earth system, and their sustainable management. A central aim is to combine these with aspects of contemporary ecological/environmental science with a view to understand better the behaviour of natural ecosystems on different timescales --- past, present and future (Dearing et al., p.4).

6.3 Complexity, contingency and nonlinearity

Some researcher holds that collapse is now all but inevitable, but that is actual form will be too complex for any model to predict. Collapse will not be driven by a single, identifiable cause simultaneously acting in all countries. It will come through a self-reinforcing complex of issues --- including climate change, resource constraints and socioeconomic inequality. We are in a period of sustained chaos whose magnitude is

unable to be foreseen.

Although cause-effect explanations remain a dominant epistemology, the view from complexity science argues against simple causative explanation. Open, dynamic systems are expected to behave nonlinearly with respect to external forcing and their internal organization. External forcing may exert their influence through the transgression of thresholds; there may be time-lags between drivers and responses, and perhaps most importantly a modern system is not separated easily from the past: we should expect that it has been conditioned or sensitized by past events, or at least bears the legacy of past forcing and responses.

Complexity science also predicts that systems may exhibit self-organization in the form of emergent phenomena: forms and structures that have evolved merely through a network of process interaction within a set of boundary conditions. Understanding the complexity of current systems in these terms is a high priority if we are to avoid environmental surprises at local and global levels. The central point to be made here is that long timescales of observation often enable, uniquely, these nonlinearities to be identified.

7 Conclusion: a future perspective through space and time unified theory

Environmental changes across historical time can produce significant developmental changes. On the one hand, they can disrupt the duration of normative transition, thus interrupting the sequence of development. On the other hand, they can offer new, more stable and more challenging opportunities. Historical events can alter the course of environmental development. The evidence reveals growing chaos in various environments in which human beings live their lives. Such chaos, in turn, interrupts and undermines the formation and stability of relationships and activities. Moreover, many of the conditions leading to that chaos are the often unforeseen products of policy decisions. Today, we face profound economic and social changes, some of which threaten to raise the degree of chaos to even higher and less tolerable levels.

We have arrived at the point where the concerns of basic, increasingly interdisciplinary science are conversing with the most critical problems we face at a global and historical level. That convergence confronts us with new challenges and opportunities: creating ‘a new perspective of environmental crime research through space-and-time unified theory’. Environmental harms/crimes have diverse aspects, phases and dimensions. On the one hand, we find national, intra-/inter-regional, and trans-regional phenomenon. It is necessary to view environmental harms/crimes from a

trans-spatial perspective. On the other hand, learning lots of things from ruins and remnants of past environmental destructions, we are apprehensive that environmental catastrophes might occur in the near future. It is necessary to view past/present/future environmental harms/crimes from a time-series perspective. Finally, as a result of this research, 'a time-and-space theory for complex dynamic green criminology' is suggested.

Notes:

1 This paper is based on the two papers. One is titled "Time and Space Theory for Complexity Green Criminology. Trilogy Phase 2: Time: Collapse of Civilization," and presented at the 12th Annual Conference of the European Society of Criminology, 12-15 September, 2012, Bilbao, Spain. The other is titled "Environmental Damage and Crime: Past, Present and Future," and presented at the Annual Meeting of the American Society of Criminology, 14-17 November, 2012, Chicago, IL, U.S.A.

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