

Chapter 2

The Sixth Mass Extinction

Although, historically, it was common belief that Earth's natural resources, such as wildlife, were inexhaustible (Worster 1988), the biosphere and atmosphere subsequently altered due to overexploitation. During the last century, the impact of humans on the world became clear with the reduction of natural resources and the consequences of excessive use. In the last 50 years, humans have consumed more natural resources than in all previous history (EPA 2009). To sustain the United States' (US) levels of consumption for every person on Earth, we would need four additional planets (Wilson 1993: 23). As a result half of the tropical and temperate forests of the world are now gone and one acre per second is disappearing (EPA 2009). Deforestation not only contributes to 25–30 % of the annual greenhouse gasses released into the atmosphere caused by human activity (Worldwatch Institute 2006; FAO 2006), but also to high rates of species extinction and extirpation as tropical forests contain about 75–90 % of all living species on Earth (Terborgh 1993). The impact is immense, especially on tropical rainforests that include the most biodiverse ecosystems containing a large variety of species (Wilson 2002). While these rainforests represent only 6 % of the Earth's surface, they contain more than half and up to two-thirds of all known species; e.g. the Amazon rainforest contains 30 % of all known species (Boekhout van Solinge 2010, 2012). In addition to deforestation and habitat degradation, the trade in wildlife has become the second hazard to biodiversity (Zimmerman 2003).¹ Moreover, the trade in wildlife is considered to be the greatest threat to certain species in particular, transcending degradation and loss of habitat (Oldfield 2003, World Bank 2005). In modern society flows of endangered species have become important to the global economy and are traded as commodities for a wide range of purposes as illustrated in Chap. 1. Animal parts are used as medicines, meat or eggs from animals are served as food, skins are used as leather products and to keep us warm, live animals are kept as pets and so on. Yet, the current size and scale of the trade seems to be more immense than

¹According to Stiles et al. (2013) the decline of natural range drives the illegal trade as it promotes contact and conflict between animals and humans.

ever before and leads to global defaunation. Defaunation is the equivalent of deforestation and the term is used to refer to the loss of species, populations and local declines in the abundance of individuals of wildlife (Dirzo et al. 2014). According to recent studies the scale and impact of anthropocene defaunation and biodiversity losses on ecosystem functions is comparable with other harmful global changes, such as worldwide pollution growth and global warming (Hooper et al. 2012).

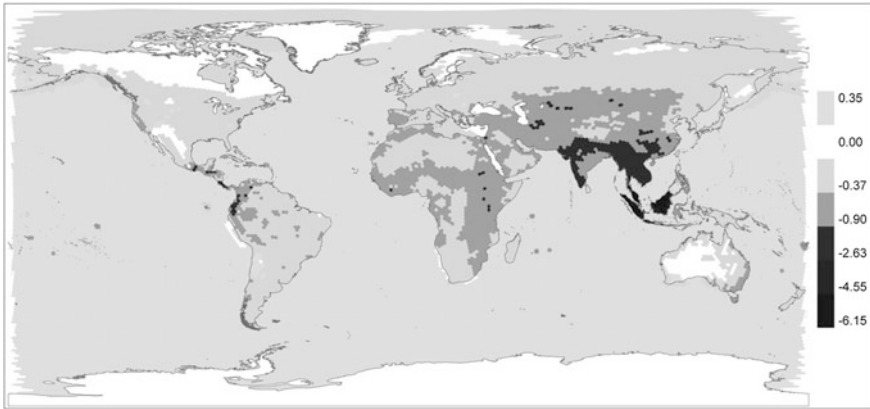
2.1 Global Defaunation and Ecological Interaction

After the five mass extinctions on Earth that were caused by meteorite impacts, volcanic activity and large-scale climate change several scientists predict that we are currently at the beginning of the sixth mass extinction (e.g. Leakey and Lewin 1995; May et al. 1995; Pimm et al. 1995; Butchart et al. 2010; Barnosky et al. 2011; Dirzo et al. 2014). Previous extinction waves include generally one half of all animal species when at least one quarter and occasionally even all animal species disappeared (Myers 1990). The first mass extinction at the end of the Ordovician period took place around 450 million years ago and it is believed to be the second largest of the five mass extinctions. The world at that time was inhabited by a large variety of marine invertebrates (e.g. molluscs, arthropods). The cause of the Ordovician mass extinction is believed to consist of alternating glacial and interglacial pulses. Around 85 % of all species disappeared (Jablonski 1991; Sheehan 2001). The second mass extinction occurred 375 million years ago during the Devonian period, known as the ‘Age of fishes’. In the Devonian era the first primitive vertebrate (tetrapod) developed the skills to live outside water on land and primitive insects and precursors of amphibians appeared. The period was characterized by the diversity of fish species (e.g. fish with jaws, ancient sharks, bony fish), for instance the prehistoric armoured fishes measuring up to 10 metres from the *Dunkleosteus* genus (Williams 2007). The Devonian extinction is believed to have been caused by oceanic anoxia and global cooling. According to McGhee (1996) around 75 % of all species became extinct. In the early Permian period, 300–250 million years ago, the supercontinent Pangaea was formed and sharks filled the ecological gap left by the extinction of prehistoric armoured fish. Two groups of ancestor mammals (*Synapsids*) and ancestors of reptiles and birds (*Sauropsids*) dominated the land area (Grose 2012). A famous example is one of the largest predators of the early Permian period, the *Dimetrodon*, with a size up to 4.6 m (Berman et al. 2001). The demise of this predator and the end of the entire Permian era 250 million years ago was caused by global warming and volcanic activity. The ‘Great Dying’ is the most intense extinction wave ever, including the extinction of up to 95 % of all species (Benton and Twitchett 2003). The restoration of species diversity took 10–20 million years and vertebrates became common with large mammal-reptile species, amphibians and the first dinosaurs in the Triassic period, 250 million years ago. Triassic was the first period of the ‘Age of the reptiles’ (the Mesozoic Era) and, as most marine genera had been wiped out by the

last mass extinction, a group of reptiles (e.g. *Ichthyosauria*) explored the ocean (Thorne et al. 2011). In addition, the late Triassic period is famous for the evolution of dinosaurs, such as the *Staurikosaurus*, *Eoraptor* and *Plateosaurus* that became increasingly dominant (Cloudsley-Thompson 2005). It is believed that 200 million years ago sea-level fluctuations (Hallam 1990) and increasing CO₂ levels by seismic activity (Beerling and Berner 2002; Hautmann 2004) caused the fourth mass extinction of 76 % of all species (Tanner et al. 2004). During this fourth mass extinction most mammal-like reptiles and large amphibians disappeared and dinosaurs began to rule the planet. In the Cretaceous period, the ‘Age of the Dinosaurs’, huge terrestrial dinosaurs (e.g. *Tyrannosaurus rex*; *Triceratops*; *Brachiosaurus*) were living next to giant sea reptiles (e.g. *Ichthyosaurs*, *Plesiosaurs*, *Mosasaurs*) and flying reptiles (*Pterosaurs*). The most recent mass extinction is believed to have been the result of volcanic activity in combination with the impact of the Yucatan meteorite and, as a result, 80 % of species became extinct (Huynh and Poulsen 2005).

Contrary to the previous mass extinctions, in the current scenario humans seem to be causing the mass extinction by unbalancing nature (Barnosky et al. 2011). For instance by, but not limited to, killing species, introducing non-native species, fragmenting habitats, spreading pathogens, co-opting resources and changing global climate. According to Wilson (1993: xxiv) “We have been too self-absorbed to foresee the long-term consequences of our actions”. During the last century, the rate at which species became extinct was about 50–500 times higher than the ‘normal’ extinction rate as can be derived based on the dating of fossils from the previous mass extinctions.² In the last hundred years, the level of species extinction increased by as much as a thousand times (Millennium Ecosystem Assessment 2005). It has been estimated that between 17,000 and 100,000 species vanish from our planet each year (Leakey and Lewin 1995; Dirzo et al. 2014; Wilson 1993). Probably this number is higher as scientists estimate that 86 % of species on Earth and 91 % in the ocean have not yet been discovered (Mora et al. 2011) and each year about 18,000 new species are found (Chapman 2009). Currently, for those that have been discovered as much as 16 to 33 % of all vertebrate species are threatened or endangered (Hoffmann et al. 2010). Based on vertebrate data an estimation of a 28 % decline in the number of individuals across species in the past four decades has been found (Dirzo et al. 2014). The rates of the decline in invertebrates (e.g. insects, worms) would be at least as severe as among vertebrates. According to Dirzo et al. (2014), over the past 40 years invertebrate numbers have decreased by 45 %. For instance, numbers as high as 26–37 % of mammals, 17 % of birds, 38 % of chameleons, 31 % of sharks and rays, 33 % of reef-forming corals and 41–56 % of amphibians experience threat levels (see also Appendix I). Insufficient data makes it impossible to estimate the percentage for the groupings of reptiles and molluscs (IUCN 2014). The largest numbers of threatened species are found in

²Generally, recovery from mass extinction episodes occurs on timescales encompassing millions of years.



Map. 2.1 Global patterns of global defaunation. *Source* Hoffmann et al. (2010)

Ecuador (2,299), the United States (1,287), Malaysia (1,236), Indonesia (1,225), Mexico (1,091), China (995), India (988), Tanzania (979), Brazil (965) and Madagascar (929) (IUCN 2014). Map 2.1 presents the global patterns of threatened land and marine vertebrates. These threatened vertebrates are mainly found in tropical regions. It is believed that by 2020, 10 million species will have become threatened with extinction (South 2008).

The complexity of the current decline of biodiversity and the effect of defaunation can be demonstrated by the sensibility of ecological interaction between animals and plants. An ecosystem consists of abiotic components (air, water, soil, atoms and molecules) and biotic components (plants, animals, bacteria and fungi). Animals are dependent on plants for food or medicines, but plants are also dependent on animals for reproduction. The distribution of seeds of plant species may take place in an abiotic (by means of wind, water or gravity) or biotic manner (with the help of animals) (Wilson 1993; Tudge 2005; Roosmalen 2008). For example, monkeys and birds are usually important distributors of seeds; toucans disperse the threatened *Virola* trees and a reduction in toucans will have an effect on its distribution (Kays et al. 2011). Even with abiotic seed dispersal animals often play an important role in ecology as eaters or predators of seeds and seedlings. Besides seed dispersal, changing biodiversity or animal abundance will affect other ecosystem functioning and services too. Dirzo et al. (2014) described how carrions are removed by vultures (Ogada et al. 2012), water stream and quality is restored by amphibians (Whiles et al. 2013), seeds are trampled by mammals (Wright et al. 2002), dung is removed by dung beetles (Slade et al. 2011), carbon cycling is carried out by worms (Barrett et al. 2008), ‘herbivory’ (the eating of plants) takes place by large mammals, litter respiration and decomposition are organized by seabirds and plants are pollinated by birds (Anderson et al. 2011). If an animal or

plant species is removed from or added to an ecosystem or a population is reduced, the consequences could be disastrous for the perennial species and its ecosystem (Wilson 1993; Roosmalen 2008). Especially the disappearance of *keystone species* would have a disastrous impact on perennial species and their ecosystems. A keystone species is a species that has a disproportionately large effect on its environment (Kellert and Wilson 1993; Mills et al. 1993; Power et al. 1996). For example, as a result of a reduction in sea star populations, mussel populations will explode and extrude most other species (Paine 1966) and, vice versa, the reintroduction of grey wolves in Yellowstone National Park has led to the recovery of the entire ecosystem from vegetation to beavers and bison (Ripple and Beschta 2006). Furthermore, the introduction or release of non-native animals (invasive species) could have serious negative effects for the stability of an ecosystem. Although several exotic species have been introduced for the purpose of benefiting agriculture or aquaculture, the side effects of these introductions include a loss of native species and changes to ecosystem functions and services (Moulton and Sanderson 1999; Mooney and Hobbs 2000).

The incalculability of defaunation is reflected in the process of *trophic cascades*. The concept of a trophic cascade arose from fieldwork and experiments by ecologists who observed the power of predators in marine ecosystems (e.g. Paine 1980; Power 1990). A trophic cascade is an ecological phenomenon with reciprocal changes in the predator and prey balance caused by the removal or addition of top predators. This would result in dramatic changes in the structure of the ecosystem. For instance, a decrease in the numbers of cougars will lead to an increase in mule deer densities and, subsequently, to more browsing intensity and a decrease in riparian cottonwood recruitment and bank erosion. Stream bank erosion may result in a decline in both terrestrial and aquatic species that live near the banks (Ripple and Beschta 2006). In practice, many trophic cascades have been initiated by humans who poach or harvest top predators, such as tigers, jaguars and great white sharks (Terborgh and Estes 2013). A dramatic example is the *ecological meltdown* in predatory free forest fragments. A study by Terborgh et al. (2001) proved that a loss of predators unbalanced the ecosystem by an increase in herbivores, a reduction of seedlings and saplings of canopy trees and plants and animal diversity being lost. The survival of specific populations subsequently depends on the correlation between the density and size of a population and its mean individual fitness. In many small populations of endangered species reproduction and survival is limited and this is caused by a mating shortage or a limited genetic variety, the so-called *Allee effect* (Courchamp et al. 2006). This ensures that a small population can extirpate at a higher rate than expected. The anthropogenic component, the ‘water and diamonds paradox’, is applied to the Allee effect by Courchamp et al. (2006: 2405): “water has much value in use but none in exchange, while the opposite is true for diamonds”. The demand for rare endangered species may have a similar effect. The rarity of a species would determine its value on the black market and,

therefore, the demand.³ The ‘anthropogenic Allee effect’ refers to the additional component of overexploitation due to a high value on the market (Courchamp et al. 2006; Hall et al. 2008). For instance, an increase in the demand for rhino horn may be caused due to its high price on the black market. In combination with a small population, gene pool and distribution range, the future chances of survival of the Javan rhino, one of the most endangered large mammals in the world with a population of less than 50 animals in Java, are extremely low (Brook et al. 2014).

The previous section demonstrates the strong symbiosis between species in ecosystems and, according to several authors, these may become unbalanced or could even collapse as a result of defaunation by the wildlife trade (Lindsey et al. 2012; Myers et al. 2007). The contemporary anthropogenic impact of defaunation is demonstrated by the high numbers of species reduction. Even a small reduction in a certain species due to trade can be fatal in terms of trophic cascades, the ecological meltdown and (anthropogenic) Allee effects. This represents the vulnerability of ecosystems and the incalculability of anthropocene defaunation. While the extent (scale, size) of the wildlife trade and species reduction has for a long time been unclear, with the current high rate of species extinction and the serious deterioration of biodiversity, the risk of a new mass extinction on Earth may become a realistic scenario.

2.2 Creation and Management of Risks

While the previous section underlined the impact of defaunation in the context of ecological interaction and high extinction rates of species on Earth, the overall effects and risks of a decline in species are difficult to estimate. According to the sociologist Ulrich Beck, the risks are part of a new phase of the industrial age, referred to as the *risk society* (Risikogesellschaft). Although in early modernity risks were seen as dangers beyond the control of man and were therefore attributed to fate or control by gods, in modern society emphasis is placed on manageability. Simultaneously, certain developments are becoming less and less manageable (Beck 1986). Giddens explained that the modern world introduces new risks that previous generations ‘have not had to face’. The ecological crisis is central to his

³The declaration of a species as endangered is believed to prove the rarity of a species and therefore its high value. Paradoxically, this declaration could result in a more desirable item and increased exploitation (Courchamp et al. 2006). After the Roti Island snake-necked turtle (*Chelodina mccordi*) was defined as a rarity, the price reached high prices up to 2,000 USD and the overexploitation led to a near extinction in the wild (Stuart et al. 2006). Courchamp et al. (2006) applied this concept to the Allee effect; ‘a positive relationship between any component of individual fitness and either numbers or density of conspecifics’ (Stephens et al. 1999). Several processes could simultaneously contribute to the decline in the fitness of an individual species (e.g. its survival probability, the reproductive rate), including the human component of its high value and overexploitation (the anthropogenic Allee effect) (Courchamp et al. 2006).

social analysis of late Modernity and would form an important part of everyday life (Giddens 1991: 4). Environmental risks have become the predominant product, not just an unpleasant, manageable side-effect of the industrial society. Characteristic effects include a decrease in biodiversity, but also large-scale disasters such as global deforestation, CO₂ emissions, soil erosion and widespread pollution have proved that environmental risks are strongly associated with the side effects of Modernity. Despite efforts by governments and science to assess and manage risks, the controllability of problems is limited and the negative effects of modernization come back to haunt us (Beck 1999). These risks are invisible, diffuse and the existing control structures, such as regulating the trade in endangered species or emission certificates, are not sufficient to manage these new risks (Roef 2003). In contrast to earlier threats, the new risks are not bound by location, time or social class, but are all-encompassing and not insured or compensable (Boutellier 2008). The risks and consequences of this modernization are revealed as irreversible threats to the lives of plants, animals and humans (Giddens 1990; Beck 1992).

The significant decline in wild animals is a clear example of these alarming developments and unmanageable risks. As mentioned before, we cannot estimate how much the reduction in biodiversity or defaunation affects society. As described in the previous section, the vulnerability of an ecosystem is presented by ecological interaction or symbiosis between animals and plants. The decline in keystone species may affect several ecosystem functioning and services. Certain trees can disappear with a decline in seed dispersers or water quality will decrease. This may also have indirect negative impacts on CO₂ emissions. Moreover, the diversity of species produces a large collection of genetic material that can be used for the development of new medicines by pharmaceutical industries. Around one out of four drugs originate from the tropical rainforest (Boekhout van Solinge 2011). The disappearance of biodiversity ensures that potential medicines will be lost (Balick et al. 1996; De Vis 2006). A biodiversity loss threatens not only the loss of plant and animal resources, but also traditional community life and cultural diversity with its knowledge of the medicinal value of various native species (Okigbo et al. 2008). The 'red list' of endangered species worldwide is becoming increasingly longer and the effects are becoming more visible (Beck 1992).

Gibbs et al. (2010) underline that the risks for human health, natural resources and the environment should be central in studying environmental issues. They explained that both direct and indirect environmental risks could be approached as the complex interaction between human and natural systems takes place on multiple scales. According to Beck (2006) the new risks that influence the world are characterized by three features: de-localization, incalculableness and non-compensability. First, de-localization: the consequences of the trade in wildlife result not only in a reduction of a population in the source region, but can also affect ecosystems in the region of destination; for example trafficked exotic species may become competitors to local species (Mooney and Hobbs 2000). "Its causes and consequences are not limited to one geographic location or space, they are in principle omnipresent" (Beck 2006: 333). Second, incalculableness: the ecological interaction between humans, animals and plants make ecosystems vulnerable to defaunation. Ecosystems may collapse,

fertile soil may disappear and water can lose its purity and clarity as described in Sect. 2.1, with incalculable consequences for life on Earth. “Its consequences are incalculable; at bottom it is a matter of ‘hypothetical’ risks, which, not least, are based on science-induced not-knowing and normative dissent” (Beck 2006: 334). However, humans change the environment and use resources at unsustainable rates in such a way that currently the side effects (e.g. defaunation, pollution, global warming) are becoming more visible. Third, non-compensability: “the security dream of first modernity was based on the scientific utopia of making the unsafe consequences and dangers of decisions controllable; accidents could occur, as long as and because of the idea that they were compensable” (Beck 2006: 334). The disappearance of species appears to be difficult to compensate. Not only does each species have a unique role in its ecosystem but also genetics and potential medicine will disappear.

In other words, the new environmental risks are not land or border-related, the effect and the duration may be poorly estimated and the causes and consequences of the complexity of the risks are difficult to calculate (Douglas and Wildavsky 1982; Giddens 1990; Beck 2006). The economic success formulas of the social order (private enterprises, the division of labour and increasing scale, unfettered scientific developments) are (partly) the causes of major risks in society (Huls 2009). For instance, fish is systematically caught and processed into food with polluting machines and rainforests are structurally cut down and turned into wood products with inevitable CO₂ emissions. Thus modern industrial societies create emerging issues, manufactured on a large scale by modern technologies that were previously unknown. The consequences of the decline in biodiversity (or global warming) are relatively invisible effects of the risk society that not only affect humans. These are not just individual risks, but risks that we share as a global society in the public interest, so-called social risks (Rademaker 2008).

2.3 The Boomerang Effect

These shared modern risks have become widespread and produce new international inequalities, primarily between the Global South and the industrialized countries in the Global North, and in the second place in the industrialized countries themselves. For instance, according to the outcomes of the United Nations Climate Change Conference in 2010, Western countries have to reduce activities that produce too much CO₂ emissions. Consequently companies transfer their activities to relatively poor countries with limited environmental regulations for factories and low wages; CO₂ emissions are therefore being ‘outsourced’ by Western companies. Generally, multinational enterprises can develop undisturbed activities due to limited controls in these countries (Rademaker 2008).

Another example of the distribution of inequalities is the exploitation of natural resources, such as mining, oil refining or wildlife poaching, that takes place in relatively poor source countries (e.g. in the last primeval forests of the Amazon and

Congo basin). According to Roe (2002) the general wildlife trade flows are from developing to developed countries. Traffickers exploit poverty and inequality to entice people to poach in territories without a government presence (Haken 2011). In these developing countries, rainforests are inhabited by millions of people who are dependent on wildlife resources of the rainforest, which disappear partly as a result of the wildlife trade (Roe 2002; Boekhout van Solinge 2010). For example, meat from wild animals (including fish) contributes 20 % or more of the animal protein in the diets of forest communities (Bennet and Robbinson 2000). Not only do these activities result in the disappearance of forests and their animal and plant species, but they also ensure that the economic and social value of the land decreases. According to Beck (1992: 38): “Property is being devalued, it is undergoing a creeping ecological expropriation”. The destruction of and the threat to nature and the environment result in a continuous devaluation and expropriation of property rights. Damaged ecosystems in a social sense are worthless or have a lower value because the habitat has disappeared and in an economic sense because the natural resources have gone, the land has been cleared and the risk of soil erosion has grown (Beck 1992).

Besides the impact on source regions (often developing countries), destination countries (often industrial states) are affected as well. A lesser known example would be the dangerous side effects of wildlife trafficking, such as outbreaks of zoonotic diseases. Increased human contact with wild animals due to the wildlife trade and habitat fragmentation causes a risk of pathogen exchange (Zommers and Macdonald 2006; Wolfe et al. 1998). When these animals carry microorganisms which could adapt to humans, this may lead to the emergence of new infections. In 2003 the outbreak of Severe Acute Respiratory Syndrome (SARS) coronavirus, a life-threatening form of atypical pneumonia, could be traced back to the relatively small trade in carnivores and bats. Joint teams of epidemiologists from China and the WHO (World Health Organization) discovered that some of the first SARS patients in Guangdong province in China worked in the sale or preparation of wild animals for human consumption. The Chinese authorities responded by imposing a temporary ban on the hunting, sale, transport and export of all wild animals in southern China (Bell et al. 2004; Lau et al. 2005). In 2003, SARS had spread within a few weeks from the Guangdong province of China to infected people in about 37 countries around the world. The first cases of SARS outside China were reported on February 26, 2003 and on May 31, 2003 and there were a total of 8,359 potentially infected cases, with a mortality rate of 14 % outside China. Ultimately, about 10,000 people were infected with 1,000 people dying and major global economic damage being caused. Initially the SARS outbreak was characterized by the scientific uncertainty surrounding the cause of the outbreak and, second, the complicated control of the outbreak through interventions or measures (Smith 2006). The damage was unforeseeable and the outbreak was (almost) uncontrollable. After the SARS outbreak 838,500 wild animals were seized in markets in Guangzhou, where masked palm civets, solar badgers, barking deer, wild boars, hedgehogs, foxes, squirrels, bamboo rats, gerbils, several species of snakes and endangered leopard cats were being sold together with domestic dogs, cats and rabbits (Karesh et al. 2005).

Both the legal and illegal trade in wild birds have also played an important role in the global spread of the highly pathogenic avian influenza (HPAI bird flu) H5N1. Since 2003, 240 people, millions of poultry, and an unknown number of wild birds and mammals have been infected and died, including endangered species (Brooks-Moizer et al. 2008). Avian influenza is a bird disease that causes flu-like symptoms, with drowsiness, watery eyes and swollen throats. H5N1 emerged in eight Asian countries in late 2003 and early 2004. Since then, the virus has spread to other countries in Asia and various countries in Europe (Zommers and Macdonald 2006). The H5N1 subtype of the avian influenza virus spread by migratory waterfowl and the (illegal) trade in wildlife contributed to the global spread of H5N1. An illegal import from Thailand to Brussels included two infected eagles (Yee et al. 2009). The wildlife trade has played a role in the evolution, distribution and transmission of the disease at fairs, exhibitions or during transportation (Zommers and Macdonald 2006).

The most recent large incidence of the transmission of zoonotic diseases is the distribution of the Ebola virus. Already in the early 2000s several human Ebola outbreaks in Gabon and the Republic of Congo were traced to meat from infected Great Apes (Leroy et al. 2004), but the Ebola outbreak in West Africa in 2014 (mainly in Sierra Leone, Liberia and Guinea) highlights the global effect that zoonotic diseases may have. The WHO estimates a total of 23,860 suspected cases and 9,675 deaths, but the WHO believes that this substantially understates the real impact of the outbreak (WHO 2015). Although flights from these areas to non-infected areas were said to be highly controlled, people became infected in the EU and US as well. It can be traced back to the trade in meat from infected fruit bats and monkeys. The virus has spread in a short period of time and has proven to be incalculable and hard to control (EFSA 2014).

An increase in the number of viruses passed from animals to humans that cause serious diseases, such as SARS, Avian influenza and Ebola has been noted (Mensink 2007). The growing volume of the global wildlife trade with rapid and cheap transportation, temporary storage facilities and common network nodes increase the risk of transmitting infectious diseases (Burgos and Burgos 2007). The wildlife trade may also be a factor in the spread of infectious diseases to other pets and wild animals (Bell et al. 2004). Every day mammals, birds and reptiles are traded through trade nodes, where they come into contact with people and native and non-native animal species. The billions of direct and indirect contacts between wildlife, humans and domestic animals, driven by technological improvement in combination with the expanding global size of the wildlife trade and modern transportation with commercial nodes, has increased the risk of the outbreak of life-threatening diseases (Karesh et al. 2005).

However, certain countries or regions are or will be more affected than others because of the spread and growth of risks. This may correspond with class inequalities and social positions relating to a fundamentally different distributional effect. The source countries generally include some of the poorest countries with the richest sources of biodiversity. Several studies have identified African and Southeast Asian countries as the main source countries for illegal wildlife (Rosen

and Smith 2010; UNODC 2010; World Bank 2008; Lawson and Vines 2014). Therefore, green crimes could be seen as a new form of colonization: Western companies use natural resources from poor countries and subsequently leave the damage behind (Passas and Goodwin 2005).

The risks of modernization, however, will sooner or later touch upon the producers who are reaping the profits (Beck 1992). Life-threatening diseases cost hundreds of billions of dollars in economic damage, a destabilization of the market and the destruction of livelihoods worldwide. Outbreaks of diseases since the mid-1990s, such as avian influenza, swine fever, bovine spongiform encephalopathy (BSE) and others, have led to many deaths and have cost the economy \$80 billion worldwide (Karesh et al. 2005). The *boomerang effect* breaks the pattern of class and national society. The rich and powerful parts of society are also not safe from the ecological (and economic) consequences of the risk society (Beck 1992).

2.4 Nature is Society and Society is Nature

The degradation of natural and ecological resources changes the relationship between nature and society. The destruction of nature has become a part of the social, political and economic dynamics. Giddens explained that ecological degradation derives from the lifestyle patterns being followed in the modernized sectors of the world society. He highlights the interconnection between personal activities and planetary environmental problems (Giddens 1991). Contrary to the perspective of the classical industrial society based on the contrast between nature and society, nature is integrated by culture in the (industrial) risk society. According to Beck (1992) at the end of the twentieth century, nature is society and society is 'nature'.

The central consequence of technological innovation and industrialisation is that in advanced modernity, society with all its subsystems of the economy, politics, culture and the family can no longer be understood as being autonomous of nature. In his article 'Biology and social theory in the environmental debate' (1994) Benton underlined that the dualist strategy of thinking about nature and society as distinct realms insist that society plays an independent role. However, environmental problems are not just problems affecting our surroundings, but—in their origins and through their consequences—are thoroughly social problems, problems of people, their history, their living conditions, their relation to the world and reality, their social, cultural and political situations (Giddens 1991; Beck 1992).

Higgins (2010, 2012) discussed the impact of *ecocide* by referring to anthropogenic environmental degradation. She explains that ecocide is "the extensive damage to, destruction of or loss of ecosystem(s) of a given territory, whether by human agency or by other causes, to such an extent that peaceful enjoyment by the inhabitants of that territory has been severely diminished" (Higgins 2012: 3). The extensive wildlife trade could be defined as a driver of the process of ecocide. She underlines that at certain points in history the world had to change. Each time,

humanity would reach a tipping point; after the abolition of slavery, the outlawed apartheid system and criminalized genocide, it would be time for the next stage: to consider *ecocide* as a fifth International Crime Against Peace (Higgins 2010; 2012).⁴

Indeed, the exploitation of natural resources has become a social problem and thus needs to be anticipated in social and scientific thinking (Beck 1992). How can we reduce the risks of a decline in biodiversity and how can we trade sustainably or find alternatives for natural resources? Ecological risks and uncertainties require constant self-reflection. This reflexive modernity can be defined as the process of self-management and self-determination on the basis of continuous detection and a reflection of all types of social information, in this case in the area of the environment (Giddens et al. 1994). Beck speaks of ‘organized irresponsibility’ in dealing with the environment. Governments are working closely with industry, employers and workers’ organizations and the major political parties, each defending their own motives to the core of the social and economic structure. The economic interests that underlie the wildlife trade trump the damage caused by the trade in wildlife (Beck 1992; Hajer and Schwarz 1996). These economic interests have obstructed the criminalization process for a long time as described in the next chapter. Nevertheless, some initiatives by moral entrepreneurs to protect wildlife species have led to the start of the criminalization of the wildlife trade by means of laws and regulations. However, the process of the criminalization of the wildlife trade is not a process of mere registration, regulation and the drafting of laws, but has to be understood as part of the socioeconomic context of European colonialism in Africa and Asia.

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