Addressing the Mammoth in the room:
The ethical and political implications of de-extinction

(Ashlock, 2013)

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“You know, at times like this one feels, well, perhaps extinct animals should be

left extinct.”

— Michael Crichton, Jurassic Park

Chapter 1: Introduction

An island full of resurrected dinosaurs is often what first comes to mind when exploring the concept of de-extinction. Movies like Jurassic Park and the general prospect of coming face-to-face with creatures that have long gone extinct certainly evokes excitement and curiosity for many people. While scientists are not currently planning to de-extinct dinosaurs, the resurrection of other animal species is no longer mere science fiction, due to technological and molecular biological advancements made relatively recently. In 2003, the first, somewhat successful, attempt at de-extinction was made by a team of Spanish and French scientists, who brought back a Pyrenean ibex, an extinct mountain goat. This was done by injecting nuclei from preserved cells into goat eggs emptied of their DNA and implanting them in surrogate mothers, only to see the species go extinct again within minutes after birth (Folch et al. 2008). Although the revival of extinct animals has been sparking our imagination for decades through science fiction books and films, such as John Brosnan’s Carnosaur (1984) and maybe most famously Michael Crichton’s Jurassic Park (1990), the topic of de-extinction did not become a popular topic in the public and academic debate, until 2013 (Martinelli et al., 2014). The Revive and Restore network, supported by TED and in cooperation with National Geographic Society, organized a conference about the topic, sparking the debate in March 2013. During this conference, conservationists, ethicists, people working on genetic and biotechnology and scientists working in other related fields involved with current species-revival projects were brought together to discuss the topic in depth, yielding the interest in de-extinction of scientist and lay people (Vassershteyn, 2013).

Extinction is usually described as a process that leads to the disappearance of a species. When the last member of a species dies, the entire genetic heritage of this species is lost. This process should not be confused with gradual changes in the genetic makeup through adapting to small environmental changes, a process which is called speciation (Eniscuola, n.d.). Extinction is a natural process, which would usually occur on a natural background rate of approximately one to a maximum of five species a year, but it is suggested that we are currently experiencing the sixth wave of extinctions (Center for Biological Diversity, n.d.). This suggestion follows from the estimation that the current loss of species is about 1.000 to 10.000 more than this natural background rate (Chivian & Bernstein, 2008). While the last five waves of extinctions were all caused by

events like volcanic eruptions, asteroid strikes, and “natural” climate shifts, the current wave is thought to be at least partly caused by humans (Center for Biological Diversity, n.d.).

While most extinctions that occur are hardly noticeable in ordinary life, because they do not majorly affect the everyday lives of most people, it is essential to realize that the cumulative effect of these extinctions can mean a dangerous reduction in biodiversity, possibly even ultimately leading to our extinction. So far, our responsibilities towards biodiversity have been mainly argued to consist of a negative duty not to destroy species. With technological developments creating new possibilities, it is an important question to ask whether these possibilities give us a new duty to repair the destruction done by humans (Taylor, 1986). Because humans most likely cause the current wave of extinction, many people are drawn to the main argument usually made in favour of de-extinction: if humans made a species go extinct, we have the moral obligation to revive it. Shapiro (2016) argues that there is a certain attraction to the opportunity of righting our wrongs. “We can have a second chance, clean up our act, and restore a healthy and diverse future before it is too late to save our own species” (Shapiro, 2016).

While popular in science fiction for decades, recent technological advancements gave rise to the ethical debate focusing on questions regarding de-extinction. Concentrating the ethical considerations and the political implications, this thesis aims to answer the following research question:

<u>On which ethical and political grounds should we (not) allow for the further development of de-extinction projects?</u>

However exciting advancements made by resurrection science are for many, some people would even say the prospect of de-extinction has a certain “coolness factor” (Sherkow & Greely, 2013), this topic should not be taken lightly. De-extinction efforts and the development of new biotechnologies are not only affecting the species which are directly involved, but influence the ecosystems they may be reintroduced in, and change the ways we can influence nature. If researchers would be successful, de-extinction will challenge the way we look at conservation and most likely our relationship with the non-human world as a whole. Within the academic debate, de-extinction is usually framed as a possible conservation tool, which implies some kind of ethical responsibility towards species we (in)directly caused to disappear, as well as towards future generations. Questions about the way we should use technology, what harms we can inflict on

our environment and what the responsibilities we bear towards non-human nature arise (Gamborg, 2014). Taking such responsibilities means we should be aware of the implications of further developing (bio)technologies and ask ourselves if and how these developments could contribute to a better society and how much interference with non-human nature we think is acceptable (Myhr and Myskja, 2014).

De-extinction is becoming an increasingly popular topic among scholars from a wide variety of fields, including biologists, conservationists, and philosophers, but the political implications and desirability of de-extinction within our society are mostly unexplored, and have so far remained a side note in the de-extinction debate. Although the significance of the protection of the environment and biodiversity is often not recognized within politics, there is a vital interdependence between humans and nature, in which different processes and parts of nature play a significant role. We might value biodiversity because significant loss may be threatening to our species, or because we appreciate the intrinsic value of the species consisting of it. Because we are currently losing species on an alarming rate, large scale political decisions need to be made regarding the way we structure our society in relation to non-human nature, and de-extinction can be an important factor in these decisions.

Within the de-extinction debate, it is crucial to recognize that most decisions concerning nature are made mainly in politics. This happens either as deliberative decisions on the use of resources or conservation efforts or as a side-effect of other political decisions. “The politics of nature is primarily about concrete decisions on resource use, modification of the surroundings, and so on, in an increasingly complicated economic, social and political context” (Haila, 2012, p. 29). Merely the fact that de-extinction will probably become a possibility does not imply that we should use it to bring back species. There is a split between science and politics, as it is in the interest of scientific advancement to pursue this possibility, while in politics, decisions have to be made about its use.

The possibility of de-extinction mostly concerns charismatic megafauna in the public debate, most famously the mammoth. In the academic debate, this question focuses more on more recently disappeared species, or species going extinct in the near future, which have a high conservation value (Siipi & Oksanen, 2014). The logic for which animals would be attractive candidates for de-extinction, depends on the reasons for and aims of de-extinction projects, and is partly influenced by the risks we are willing to take. Some species might be scientifically interesting, while at the same time being potentially dangerous for

our well-being, and other species might be tempting to exploit commercially, while their conservation or scientific value might be relatively low. Similar issues occur, for example, with rewilding as a conservation strategy, as the costs and benefits for the local communities and those of the regional or even global community should be balanced. Before proceeding with the development of bio-technologies, we should investigate what kind of society we want to have in the future and what our relationship with non-human nature should be. This includes an increased focus on how our society can and should be restructured to create an enduring relationship with the non-human world, and we ask ourselves if and how de-extinction would fit into this.

As the causes of extinction are often linked to human behaviour, there should be changes regarding our behaviour as well, if humanity wants to slow down the alarming extinction rates. An important argument is that de-extinction might be merely a temporary, technological fix. Beattie & Ehrlich (2013) argue that the de-extinction of species does not necessarily change human behaviour, while these changes are needed to tackle the current loss of biodiversity. This might blind us for the societal changes needed to tackle the loss of biodiversity permanently. Furthermore, another political consideration is that it is currently, and de-extinction projects may be a bad investment, especially when keeping in mind that the money spent could have been used to prevent other species from going extinct (Cohen, 2014).

These challenges fit well into the broader question of how we should interact with and intervene in nature. Siipi and Oksanen (2014) state that it is natural to wonder what the world would look like if an extinct species would still exist. By providing a new possibility of de-extinction, we face a similar question: if an extinct species would exist again, what would the world look like? “Even if the goal of bringing back extinct species remains elusive, thinking about de-extinction is a useful hypothetical exercise. For those of us who believe that ecological restoration is often a very good thing, thinking about de-extinction can help us get a bit clearer about what we’re committed to” (Turner, 2014, pp. 41).

1.2 Thesis structure

To answer the research question in a clear and structured manner, this thesis will start by outlining what de-exinction is, by first exploring the concept of extinction in Chapter 2. This chapter will discuss different relevant concepts and terms relevant in the de-extinction debate. While concepts such as species and extinction are commonly used in the public debate, within biology, they are difficult to define. Back-breeding, cloning, and genetic engineering are discussed

as technical approaches to de-extinction, before elaborating on the theoretical possibilities of de-extinction. Even if we would be technically able to create genetically exact copies of species that have gone extinct, is this sufficient for it to count as a member of that species? Furthermore, Chapter 2 will consider some factors that should be taken into account when selecting possible species to re-create, resulting in some general criteria to keep in mind. The selection of species is not merely a scientific debate, in which the technological feasibility is considered. Instead, it will strongly depend on our reasons to de-extinct a species.

In Chapter 3, some often mentioned motivations for de-extinction are summarized. First, arguments that focus on the well-being of individual non-human animals are discussed, before moving to our moral responsibility to species in the second part. Many arguments in favour of de-extinction contain an element of restorative justice, but it is questionable if we can have a moral responsibility to an abstract entity such as 'a species' that exceeds the responsibility we may have to each of its individual members. Thirdly, the value of the creation of these artificial animals is considered, as "unnatural" species may be valued less, either because of their mode of creation, their behaviour or their connection to the original ecosystem. Fourthly, this chapter investigates the influences de-extinct animals can have on the ecosystem they are (re)introduced in. These influences can be both positive and negative. These animals can be transmitters of diseases, can become invasive and create an imbalance in an ecosystem, or will simply not have a sufficient enough significant impact to justify its recreation. On the other hand, the de-extinction of animals can have positive impacts on conservation, either directly, by increasing the biodiversity, by fulfilling an ecological niche and restoring the balance or health of an ecosystem, or indirectly, by contributing to advancements in (bio)technologies, which can in turn be used for conservation purposes. Fifthly, the moral hazard problem is considered as an objection against de-extinction. This hazard, put simply, holds: if extinction is no longer permanent, will we care less about the conservation of currently existing species? Lastly, the sixth argument considered concerns the possible aesthetic, cultural or recreational values of de-extinct species.

The weighing and considerations of the pros and cons of de-extinction, depend partly on the way we value nature and the relationship human beings have with their environment. Chapter 4 will focus on rewilding and the diverse ethical and political possibilities it offers in combination with different schools of environmental political thought, as rewilding provides important analogies to de-extinction and thus provides important insights on de-extinction and its practice and politics. It will consider "green" alternatives to our current society, and the

changes necessary to transition to these societies. First, this chapter will discuss rewilding as a conservation strategy, discussing its origins and different conceptions. Secondly, a more primitive society is discussed, based on ideas derived from ecologism or Deep Ecology. Thirdly, a society based on environmentalism, a more anthropocentric approach, is discussed. Distinguishing between weak and strong anthropocentrism, ecological pragmatism is included as a more intermediary position. Fourthly, a relatively recent addition to environmental philosophy is discussed, starting with the ecomodernist manifesto, this chapter will consider the ideas put forward by the ecomodernist approach. These alternatives are compared on the basis of their philosophical merit, as well as their political viability and practicality in dealing with the issues of, for instance, loss of biodiversity.

To further investigate the possibilities these societies/perspectives offer for de-extinction and the risks they present, the Chapter 5 will review the alternatives presented in Chapter 4. Offering the least room for de-extinction, the primitivist and (eco)modernist societies are discussed first, after which a society based on environmentalism is discussed. Included in the environmentalist approach is the ecological pragmatist perspective, as it incorporates both ecocentric and anthropocentric arguments and instead focuses on the practical implications. The term resilience is added to the concept of sustainability, as it leaves more room for changes and is a more suitable way to review rewilding practices.

In the conclusion I will eventually aim to answer the research question. Focusing on the complexity of ecosystems and nature as a whole, I claim that humans often know too little about this complexity to successfully intervene. The risks posed by de-extinction, but the development of these technologies can still be worthwhile for other reasons. Either directly for aesthetic benefits, and the advancements of our scientific knowledge, or indirectly, by the possible conservation goals these benefits can contribute to. The discussion of the relevant concepts and perspectives cumulate in the conclusion that de-extinction projects for conservation purposes should be restricted due to the high costs and serious risks which are involved, but are not to be completely rejected, as the projects may still offer other benefits.

Chapter 2: De-extinction and species selection

This chapter will outline what de-extinction is, by first explaining what species are and the extinction of species as generally perceived as something negative. This chapter will then explain what the current possibilities for resurrecting a species are and how these different approaches work. Moreover, this chapter will elaborate on the selection of species for de-extinction by formulating some selection criteria.

2.1 Extinction

Usually, when exploring the concept of de-extinction, the focus is on species that have completely gone extinct, not on the ones that gradually changed into one or more other species. The answer to the question “what is a species?” is fuzzy,

even in biology. The most widespread answer to this question is the following: “Species are groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups” (Mayr, 1942). This definition is somewhat limited, as it does not include a significant proportion of microbial life and different asexual species, but this general definition will be sufficient for this thesis. As these asexual groups do not hold characteristics that make for radically different political and ethical perspectives. Extinction as a concept is often separated from gradual changes in the genetic makeup through adapting to small environmental changes, a process which is called speciation (Eniscuola, n.d.). Delord (2014) states that the reason for this difference is “that the return to life and the development of an additional phylum in the tree of life, the survival of an original process of evolution, and the transmission of certain genetic features and information are really valued from an ecological point of view” (pp. 23-24). When the last individual member of a species dies, its entire genetic heritage is lost. Although extinction is a natural phenomenon, occurring in various ways, it is suggested that we are currently experiencing the sixth wave of extinctions (Center for Biological Diversity, n.d.). The effect of this loss is greatest when the species had an irreplaceable functionality in the ecosystem, or when it was previously abundant (Wardle et al., 2011).

The literature concerning de-extinction often overlooks the question of why it matters if species go extinct. Many authors simply take the assumption that it is negative when species go extinct as a starting point, and while most people would agree, it is not entirely clear on what basis people make this assessment. Shapiro states that extinction is a natural part of life and a normal consequence of processes such as speciation and evolution (Shapiro, 2016). She notes that more than 99 percent of species that have ever lived are now extinct, and without these extinctions humans would probably not have existed. Despite the past five mass extinctions, more species exist now than at the beginning of the evolutionary processes. Oksanen (2014) argues that processes are ultimately the objects of biodiversity policies, rather than individual entities. These policies should aim to ensure that current outcomes of these processes are not deliberately broken and that further diversification can occur, for example, through processes of speciation. Shapiro proceeds to set out three different reasons why people fear extinction (2016). First, she argues, we are afraid we will miss opportunities. What if a species turns out to be crucial to the cure of a disease or to have critical importance in the balance of an ecosystem? Secondly, we fear change. It is hard for us to anticipate changes in the world around us. And third, Shapiro argues we do not want to fail. We enjoy living in a world rich in biodiversity and feel this brings a certain obligation to ensure this world, even

though paradoxically we often cause this destruction ourselves (Shapiro, 2016).

While the instrumental value of biodiversity and diversity of species for humans seems clear, this does not automatically give value to all species, as long as there is still enough diversity. The extinction of a single species may not be harmful in itself, as long as enough biodiversity remains. To determine if and on what basis we have special commitments towards species, well beyond the obligations we may have to individual members of this species, some kind of intrinsic value of species should be determined. Cohen (2014) rightfully points out that proving that there is some kind of intrinsic value, is notoriously difficult. He points to Ronald Dworkin (1993), who writes that it is a "cosmic shame when a species that nature has developed ceases, through human actions, to exist" (p. 75) and John Rawls who argues that the destruction of an entire species could be a great evil (1971). Schweitzer states: "Ethics, too, are nothing but reverence for life. That is what gives me the fundamental principle of morality, namely, that good consists in maintaining, promoting and enhancing life, and that destroying, injuring, and limiting life are evil" (1987, p. 93). But, that does not necessarily mean that the extinction of a whole species is worse than an equal amount of animals from different species dying. Elliot (1994) states it is less acceptable to kill the last member of a species than to kill a member of a non-endangered species. As many people intuitively agree with this statement, there seems to be some kind of intrinsic value to species.

There are both anthropocentric and ecocentric reasons for perceiving extinction as a bad thing, however determining why extinction is bad, does not necessarily justify de-extinction. Chapter 3 will further elaborate on the motives for de-extinction and Chapter 4 on different environmental perspectives.

2.2 Approaches to de-extinction

What would count as de-extinction, even in the theoretical sense, remains a topic of discussion (see §2.3), but in practice, there are roughly three approaches to de-extinction. These are back-breeding, cloning, and genetic engineering (Shapiro, 2016). These new biotechnologies and more generally scientific advancements offer new possibilities, not just for reversing extinctions, but also for avoiding them (Oksanen and Siipi, 2014).

2.2.1 Back-breeding

The German brothers Lutz and Heinz Heck probably attempted the first science-based resurrections of an extinct species, in the 1920s and 1930s (Oksanen and Siipi, 2014). They were zoologists who tried to de-extinct the aurochs which

became extinct in 1627, through an approach known as back-breeding. Because of their ideological focus and their link to the Nazi party, these cows are now more commonly known as “Nazi cows” (Shapiro, 2016). Back-breeding uses selective breeding to bring back ancestral traits within an existing species. Similarly to more commonly used selective breeding, individuals are selected on physical and behavioural characteristics. The aim for de-extinction is not to create or enhance new traits, but resurrect traits that have been lost by the extinction of a species that was a close relative to the species used for back-breeding. This approach is not overly sophisticated and is based on three facts that are outlined by Shapiro (2016) as follows. First, the physical and behavioural characteristics (the phenotype) are determined by the sequence of the individual’s genome (the genotype) and the interaction of this genotype with the environment. Second, genotypes are passed down from parents to their offspring. And third, natural selection can change phenotype within a population (Shapiro, 2016). This approach takes advantage of nature’s own processes of genetic engineering by selecting desired phenotypes and breeding them with each other (Shapiro, 2016).

The Heck brothers used historical descriptions and bone specimens, but this approach gave them no insight into the animals’ genetic relatedness. Although after many generations back-breeding may successfully restore the desired phenotype, the genetic makeup of the created animal, may still differ greatly from those of the extinct species (Sherkow and Greely, 2013). The resulting Heck cattle might look like their “ancestors” but in reality, bear little resemblance to the aurochs. In other words, the created species will most likely not contain an exact copy of the genome sequence of a purebred auroch, even though it will look like it (Shapiro, 2016). This might seem, at least in some cases, irrelevant to their function in an ecosystem, but as genes often have multiple functions and act in concert with other genes (Shapiro, 2016), recreating a particular phenotype, might have other unintended consequences.

It is difficult to determine at what point one can call an individual animal a member of the once extinct species (Richmond et al., 2016), as back-breeding involves animals of many generations. One could argue that several (sub-)species are actually created, depending on how a species is defined. Another drawback is that it can only be an option for extinct species that are very closely related to a species that is still living. Due to the high number of breeding generations, as well as the lack of control of the genetic makeup, it is not an efficient option for de-extinction species that differ on more than a couple of traits from their living relatives (Richmond et al. (2016). Selective breeding also causes a higher chance of inbreeding within the population, which could be disadvantageous for a

species' overall fitness. This point is essential to consider when looking at the possibility of reintroducing this de-extinct species back into the wild (Shapiro, 2016). Efforts to de-extinct species through back-breeding have been mainly focused on the quagga and the aurochs (Richmond et al., 2016). Although these attempts might not have been entirely successful, nowadays we know more about species and their traits and phenotypes than we did in the twentieth century (Shapiro, 2016). So, granting back-breeding would not exactly recreate a species, it can be a useful technique to recreate a desired phenotype to fill a gap in an ecosystem.

2.2.2 Cloning

Another approach to de-extinction is cloning. The most well-known attempt of de-extinction by cloning was a Pyrenean ibex, which was brought back by injecting nuclei from preserved cells into goat eggs emptied of their DNA and implanting them in surrogate mothers in 2003 (Folch et al., 2008). Because of its aim to create a genetically identical copy of the extinct species, unlike back-breeding, cloning could be a very attractive alternative approach to de-extinction. The word "cloning" refers to a technique known as "somatic cell nuclear transfer" (SCNT). With this technique, the nucleus from an adult somatic cell (a type of cell that makes up most of the cells in our body, including skin, muscle and heart cells), is injected into a nucleated egg and then reprogrammed by the host egg cell (Shapiro, 2016). This process is similar to the way an embryo would develop following fertilization by a sperm cell. For the purposes of this thesis, it is not necessary to go deeper into the exact biological workings of this approach, yet similar to the back-breeding approach, close relatives to the extinct species are still necessary for this approach to be successful.

Despite being an attractive alternative to back-breeding, cloning requires intact living cells, which are generally not available for most extinct species. DNA-tissues begin to decay almost immediately after death (Shapiro, 2016), so at least for now, it is not a good option for long-lost species. For species that went extinct very recently and species going extinct in the future, it is possible to create clones from cells that have been collected prior to death (Shapiro, 2016). In practice there has not been a successful attempt in cloning as an approach to de-extinction, as the most successful attempt, the recreated ibex, died only minutes after birth (Richmond et al., 2016). For now, cloning as a method to de-extinct a species is not very efficient and is only feasible in a few very recent extinctions of which exceptionally well-preserved DNA is available (Sherkow and Greely, 2013).

There are still significant challenges, although technical difficulties might be

overcome through future technological breakthroughs. The major challenge that remains is that this approach, used on its own, is only applicable to extinct species from which exceptionally well-preserved DNA is available. A suitable candidate for de-extinction through cloning could be the Thylacine, more commonly known as the Tasmanian tiger. Cassita et al. (2015) suggest bringing back this species can decrease the overpopulation of rabbits, a non-native invasive species, which was brought to Australia in 1859. De-extinction of the Tasmanian tiger will be possible, as enough high-quality genetic material has been preserved to sequence the species' entire genome (Pickrell, 2017). It is also a fitting candidate for de-extinction both ecologically and scientifically, because of the lack of predators in Australia and the uniqueness of it being the largest marsupial predator in recent times (Pask, 2017).

2.2.3 Genetic engineering

A third approach aims to edit the genome sequence within cells of a closely related living species, to create an animal that has identical genome sequence of the extinct species, or at least very closely resembles it. This results in living cells, which in turn can be used for somatic cell nuclear transfer, as mentioned in the cloning approach. It combines recent developments in two fields, namely ancient DNA and genome editing. Drawbacks are that even with technology improving, most likely not all ancient genomes will become available, and it is still challenging to recover DNA. Due to the fragmented nature of most ancient DNA and therefore missing information, making identical copies of long-extinct animal species is nearly impossible (Shapiro, 2016). An often-mentioned candidate for de-extinction through genetic engineering is the Passenger pigeon (Kasperbauer, 2017). The Passenger Pigeon species has left enough DNA samples to allow full-genome sequencing of high-quality. In this case, DNA cells from a similar species, such as the band-tailed pigeon, may be edited to match the genomic sequence of the passenger pigeon. By using targeted replacement, the genome could be reconstructed within several generations.

With this approach, some authors argue, even long lost species like the woolly mammoth is a candidate for de-extinction. Finding undamaged or uncontaminated DNA of the mammoth is almost impossible (Oksanen and Siipi, 2014). Therefore, ways to repair and complete degraded genomes are necessary for these species. The biggest drawback of this approach is its complexity. While scientists managed to complete the genome sequence of a living "Mycoplasma mycoides" bacterium (Shapiro, 2016), this genome is minimal compared to bigger animals. Shapiro (2016) states that the bacteria has little over a million base-pairs, while birds have genomes of more than one billion base pairs long and a big

mammal like a mammoth approximately 4 billion. Bacteria also lack a nucleus, which eliminates the unsolved step in the life creation process: the creation of a genome compromising multiple distinct chromosomes within a nuclear membrane (Shapiro, 2016). This is a complex and challenging process, but many scientists believe that it is a matter of time before it is possible. “Whether it is in five years, five decades or five centuries from now, woolly mammoths will once again walk the earth” (Stone, 2003, p. 215).

2.2.4 Mixed approaches

Often approaches are mixed within one project. Oksanen and Siippi (2014) explain how cross-species cloning can be a first step, after which back-breeding is used to enhance certain features of the extinct animal species, so the offspring becomes more and more like this species. Nonetheless, none of the approaches, even combined, can generate an organism that is the same as the one that went extinct. Even with cloning, the clones will grow within the eggs and uterus of a different species, influenced by their diet and environment of this surrogate species. When the animal is born, a surrogate species will raise it, which may have distinct behaviors and social constructions (Shapiro, 2016). The behaviour of an animal is either mostly instinct-based or predominantly a result of learning. Therefore, more solitary animals that are more instinct-driven could be closer resembling the extinct species they are created to be part of, compared to animals with more complex social structures (Oksanen & Siipi, 2014).

2.3 Ontology of species

Technical developments are happening fast, and the probability that even the significant technical difficulties mentioned before can eventually be overcome in the future is high, but many authors question the theoretical possibility of de-extinction. Although this is not an ontological thesis about the species identity of animals, it is useful to look into these considerations briefly and to evaluate if and how they matter for the purposes of this thesis.

Would the re-creation of a species actually result in a member of the extinct species? And is the genetic makeup of the individual both a necessary and sufficient condition for species membership? There different views regarding the ontology of species, leading to fundamentally different answers to these questions. Species have been treated as a fundamental concept in biology and has more recently become crucial for biodiversity conservation (Balakrishnan, 2005). Classification, listing, and counting of rare species are currently central to the global protection of biodiversity (Barrow, 2009). Due to the length and scope of this thesis, it is not possible nor useful to fully outline the biological debate

about the species concept. But roughly we can see a tension between the concept of a species as a coherent whole and species as a gathering of individual animals.

Oksanen and Siipi (2014) also put forward two perspectives on what makes an animal part of a species. Genome- and morphology-centered conceptions of species see the ecological interactions with their environment, social relations and the way they come into existence as insignificant to the identity of that species (Oksanen and Siipi, 2014). Taking this perspective, we can argue it is possible to re-create an extinct species as long as it is possible to copy its genetic information, however, as this essentialism has lost most support among biologists, a new metaphysical definition of species emerged, Garvey (2007) argues that next to its genetic similarity, there should also be a connection or a "causal contact" between animals. According to this view, de-extinction is not possible, as the individual animal created would fall outside the "conventional species taxonomy" (Oksanen and Siipi, 2014, p. 12). These different metaphysical conceptions of extinction and de-extinction are not exhaustive but do show that there are different understandings of what constitutes a species.

The "naturalness" of the de-extinct animal is put into question by many authors, although there is not even consensus on the question if a lack of naturalness would even be problematic. Switek (2013) argues that de-extinction projects create new species rather than reviving what is lost. Therefore he argues, that de-extinction per definition fails its own premise. This seems to be a common concern, as Sandler (2013) also highlighted that "organisms resulting from de-extinction may not even be conspecific with the species that went extinct" (p. 356).

Siipi (2014) argues that if animals cannot, even in theory, be de-extinct, in the sense that they are members of the extinct species, the justifications for using these methods is weakened. Even if it is theoretically impossible to resurrect species, creating new species that closely resemble extinct species can still be useful to reach the objections or aims of de-extinction for conservation purposes (Shapiro, 2016). Focusing on these goals, questions about naturalness, or the ontology of species would become less relevant. If the objection of de-extinction is to restore or improve the ecosystem health, to re-establish the unique relationships between species which no longer occur due to the extinction of one or more of these species, the aim should not be to create exact copies of the once-living species (Shapiro, 2015). The treatment of species as conservation units can still serve both pragmatic and political functions, even if they are ontologically not members of the same species. "In the majority of ongoing de-

extinction projects, the goal is to create functional equivalents of species that once existed: ecological proxies that are capable of filling the extinct species' ecological niche" (Shapiro, 2016, 1001). One's perspective on the possibility and usefulness of de-extinction is therefore not just dependent on what constitutes a species, but also on the goals that we set and the selection criteria of the species to de-extinct.

2.4 Selecting species

If we assume that technological advancements will lead to the possibility of exactly copying the DNA of species in such a way that we are able to bring back a species or a new species that closely resembles the extinct species, we can start thinking about suitable candidates for de-extinction. There are multiple questions to consider, depending on the goals that are set for de-extinction. In her book "How to Clone a Mammoth" Shapiro (2016) shows how many factors can be taken into consideration when selecting possible species for de-extinction. It is important to consider whether the de-extinction is technically feasible and whether there is a suitable habitat for a species to be reintroduced in, but the more difficult questions do not relate to whether a species can be brought back, but if they should be brought back (Shapiro, 2016). Besides the importance of the de-extinction being technically possible, it is also necessary to determine if there is a place for this species to live if we successfully bring it back. Is it even possible to reintroduce this organism into the wild? And if so, how would these species affect the existing ecosystem? Shapiro (2016) makes a strong case that the mitigation of guilt is not a compelling reason to bring a species back. More convincing arguments she puts forward are related to the role these species are likely to play in the environment nowadays, or if their absence causes destabilization of an ecosystem (Shapiro, 2016). Additionally, she points towards the restoration of lost interactions between species and thereby preventing further extinctions.

Shapiro (2016) argues that taking keystone species as criteria to select a species for de-extinction, causes a paradox. While some species would be too similar to currently living species to justify their de-extinction on the grounds of ecological benefits, other species would be too costly (Shapiro, 2016). She concludes the ideal candidate for de-extinction would have sufficiently closely related living relatives to make its extinction technologically feasible, and having unique traits or place in their ecosystem. Additionally, the ideal candidate for de-extinction may be one that only recently has gone extinct. As ecosystems adapt quickly, de-extinction of a species that has gone extinct thousands, or even several hundred years ago, would destabilize the adapted ecosystem and might do more harm

than good. We have to carefully evaluate both the risks that are involved with bringing back a species, as well as their potential beneficial impact on the environment the present day (Shapiro, 2016). Possible choices could be species that recently went extinct, because of the availability of their DNA, but also because of the place they can take in an ecosystem. A previously mentioned example is the Tasmanian tiger, as high-quality genetic material for researchers to sequence the animal's entire genome has been preserved. Because of its unique position in the ecosystem as a native marsupial predator which could solve problems that invasive species cause, this species could be a fitting candidate.

Aside from their ecological value, choosing which species we should de-extinct can be decided on the grounds of several different arguments as well, including aesthetic, scientific, or cultural values. Myhr and Myskja (2014) discuss how there are strong cultural elements that influence which species we value. Some are considered more valuable than others because they connect to recreational and aesthetic values influencing the way we value nature, which is strongly context-dependent. The choice of species generally tends to focus on charismatic megafauna, particularly mammals, rather than plants, which seem to lack the necessary charisma (Lorimer, 2007). Although this makes this selection seem arbitrary and purely based on instrumental value, such species have a bigger chance of increasing the public interest in wildlife conservation (Jones, 2014) and thereby potentially benefiting less charismatic species as well. Oksanen (2014) states that the choice of which species and natural areas worth protecting is to some extent a matter of political choice. Not everything can be conserved or restored, and thus, political decisions have to be made.

The selection of species to de-extinct will strongly depend on the motives that we have to be in favour of de-extinction. The species need to fit the goals set out by these motives in order to be considered; this is more important than merely looking at the technical possibilities. We should not only consider which species we *can* de-extinct but also which ones we *should* de-extinct, if any. The next chapter will discuss various motives for de-extinction, as well as objections made by several authors, to determine which motives prove to be most convincing.

Chapter 3: Motives for de-extinction

Many authors argue that even if and when we would be fully able to understand and use de-extinction technology, extinct animals should still stay extinct. Projects working on de-extinction remain highly controversial, and many issues

have been raised about animal welfare and the environmental impact of reintroduced species (Martinelli et al., 2014). Moreover, health issues, as well as moral arguments, are central to the objections people have against de-extinction. Other authors who argue in favour of de-extinction point to the greater scientific knowledge and technological advancement that this could lead to, concrete environmental benefits, as well as a certain moral obligation and even a "coolness" factor, or aesthetic value.

3.1 Animal welfare

In the article "Should we bring back the passenger pigeon? The ethics of de-extinction" Kasperbauer (2017) argues that the most challenging aspect of de-extinction is that it would involve harm to individual sentient animals. With the current state of technology, there are good reasons to believe that de-extinct animals will suffer as a result of the process (Kasperbauer, 2017). The cloning itself involves welfare issues, such as a high death rate after birth, but also the animals that would live to adulthood and their offspring will probably possess deformities and suffer from other health issues (Kasperbauer, 2017). The animals created by genetic engineering, specifically in the case of somatic cell nuclear transfer (SCNT), are known to have a high risk of deformity and early death (Sherkow & Greely, 2013). “Many cloned animals suffer from impaired health including placental abnormalities, foetal overgrowth, prolonged gestation, stillbirth, hypoxia, respiratory failure and circulatory problems, malfunctions in the urogentical tract, malformations in the liver and brain, immune dysfunction, anaemia, and bacterial and viral infections” (Gamborg, 2014, pp. 65)

Although animal welfare should be an important consideration, the suffering inflicted upon individual might be avoidable with the further development of technologies used. There is some good reason to believe that technology is improving in such a way that this objection can be overcome. At the very least, it should become evident that the future animals at least have a life worth living enough to justify the creation of the first animals Gamborg (2014) states that if the animals which are created through de-extinction technologies are at least as well off as the animals which would have existed without the use of these technologies, the use (of these technologies) can be justified. Such decisions should always be carefully deliberated upon, as animals should not be made to suffer unnecessarily.

Additionally to physical suffering, there are also concerns about the animals being exploited for purely human interests, as it is hard to argue that the animals or recreated species benefit from de-extinction. Will it meet the interests of species’

individual members, or are individual members sacrificed in order to revive the species (Kasperbauer, 2017)? Kasperbauer (2017) argues against the notion of species' interests and states that justifying de-extinction on these grounds should be seen as illegitimate. On the other hand, even de-extinction technology does inflict harm to individual animals, it could be argued that inflicting suffering to individual members of a species, for the existence of the whole species, would be morally permissible, or even our responsibility.

3.2 Moral responsibility and species rights

The argument of moral responsibility is a compelling one in favour of de-extinction. It is an intuitively attractive argument for de-extinction and the desire to repair the damage that has been done by us seems to be common. Humans are reshaping the planet, and while doing this, we often do a lot of damage. When a species is lost because of human influences, many people feel like it is our obligation to bring it back. Keeping this in mind, it is no wonder that a retribution argument is gaining ground. Considering that humans seem to be at least partly accountable for the disappearance of species, for many people, this implies that humans have committed a moral wrong to these species in some sense. It seems this intuition is common, although it is tough to find valid reasons to support it (Palmer, 2009). Arguing for a certain moral responsibility towards species, implies that certain species which went extinct have a claim against us, which means that they can be the bearers of rights or are able to have interests. It seems hard to argue for species rights, because a species is usually perceived as merely a taxonomic entity, but it is also hard to ignore that there is some kind of importance to species, above and beyond the accumulation of their individual members. Could causing the extinction of a species be considered as the destruction of something morally significant, independent of its usefulness to ecosystems or human beings (Palmer, 2009). And would reviving this species restore this lost value?

Many people would agree that the last individual members of a particular species are worth more than the individual members of a species that is not endangered. Palmer (2009) supports this by arguing that it can be in the interest of a species to hurt all individual members of this species to ensure its survival. The suffering of an individual animal of natural causes sometimes makes sense for reproduction and the continuing existence of the species, but does not always make sense in terms of the interests of these individual animals. Richard Dawkins writes: “natural selection is indifferent to the intensity of suffering, except in so far as it affects survival and reproduction (2009, p. 188)”. Because something could be in the interest of a species that is not necessarily in the interest of the individual

members of that species, species themselves can be considered to be of moral significance. Focusing on the species perspective in terms of survival, we can conclude that the interest of a species is not merely the accumulation of the interests of its individual members. To support the idea of a species as a natural entity, Johnson and Wroe (2003) argue that “a species is the kind of individual that’s a living entity, one that takes the form of an ongoing process that maintains near equilibrium with its environment” (p. 478). This kind of life has interests that can be distinguished from the sum of the interests of the individuals.

Smith (2016) focuses on the importance of flourishing of species, instead of speaking about interests. Flourishing means that a species can continue to reproduce successfully and therefore staying safe from extinction. On this basis, he challenges Kasperbauer's (2017) claims that reviving the passenger pigeon species is illegitimate. He supposes that if enough members of the passenger pigeon can survive to reproduce and to such extent that they are no longer threatened with extinction, this species would be flourishing again and that this should be weighed against the interests of individual passenger pigeons. Therefore, we should not dismiss the possibility that engaging in the process of de-extinction could be morally legitimate.

Sandler (2013) argues that species lack welfare and interests and are therefore not right holders. In the traditional deontology tends to the view that a duty requires at least one holder of rights. It is often asserted in environmental ethics that responsibilities should be understood as general principles of proper conduct, rather than traditional rights-based duties (Jebari, 2016). Jebari compares this with the civic duties we can have to our local community, as they cannot be reduced to duties towards individual members of the community, nor can the community be said to have rights. Jebari (2016) assumes a negative duty, only posing a duty to "abstain from becoming responsible for the extinction of species" (p. 3). O'Neil (1997) states that even if a species would have its own interests, it would still be unable to have a moral standing because it lacks sentience, but in terms of its intrinsic value there can still be a foundation for obligations towards certain species.

There is no consensus if and on what basis species have rights or interest, which would give us a certain responsibility to them. Even if we are responsible for the extinction of a species and we are able to revive it, to who exactly would we owe this, as the species is extinct and therefore no longer existing? Once a species goes extinct, the bearer of these rights would also cease to exist, leaving nothing to have a responsibility towards. Consequently, asserting species rights would at most give us either a negative or positive duty to prevent future extinctions. Additionally, if we were to de-extinct all species that went extinct because of human action, then we have to bring a lot of things back without which we are far better off, including diseases such as the smallpox (Tanasescu, 2016b). This leads to a dilemma, as most people would not want harmful species to return, species should be selected on another basis than us being responsible for their extinction.

As argued in Chapter 2, it is questionable if a species can be de-extinct, or if we would merely create a new species that closely resembles the extinct species? If the best we can do is creating an exact copy of a species, it does not make sense to claim we right the wrong we did to the extinct species, but by creating "new" species, we might add some value, even if species are not actually de-extinct.

3.3 Naturalness

Chapter 2 already briefly discussed the naturalness of de-extinction. This concern is part of the fake nature debate. In the case of de-extinction, there is primarily focus on the fear that the behavior of newly created species would be not necessarily the same as the original species and that their connection with their original habitat is lost. This seems like a valid concern, especially as the place within the ecosystem is often an important consideration in the selection of species to de-extinct. This concern is not unique for de-extinction, as the same can be said in the case of the reintroduction of species into new habitats, for example as part of rewilding projects. Even if we would find a way to make species exactly like their once extinct counterparts and we make sure they fit into their new habitat, as conservationists do when re-introducing species, there would still be problems according to some authors. Katz (1997) argues on this issue that the restorative ideal does not grant any natural value, only instrumental value. Thus, recreating extinct species does not even partly restore the value lost with their disappearance.

Robert Elliot (1982) also argues against the restoration thesis: "The idea that a natural ecosystem can and should be restored, and that this restoration would reverse the harm caused against the environment" (p. 83). He claims that it would be worse to destroy the Mona Lisa and create an accurate copy than to preserve the original. However, it could be argued that recreating does not need

to be "just as good" as never exterminating a species, just that it is better than not re-creating it once it is lost. Jebari (2016) points out that Elliot's (1982) proposition is founded on some problematic assumptions. Primarily, it assumes that objects created by us, with technological processes, are capable of stripping things of their value. This assumption seems arbitrary, especially when deciding what change is natural and what goes beyond our biological and evolutionary capacities. As examples to show this problem, Jebari (2016) mentions the grasslands in Europe and the reintroduced wolves in Nordic countries. Can these be considered natural? And if not, does this mean their value is lost? Cohen (2014) argues that as we are not expressing original human design when recreating species, de-extinct species would not be products of our imagination and therefore they should therefore not be viewed as "human-made".

Mason (2017) also explores the naturalness of de-extinction. She argues that at least in their mode of creation, de-extinct animals would indeed be unnatural. Even the de-extinct animal itself would be arguably unnatural, because while it might have the precise genetic make-up as the extinct animal, the factors that influence their physiology, behaviour and ecological system, almost certainly differ (Mason, 2017). Mason (2017) argues that although unnaturalness is usually perceived as a bad thing, de-extinction cannot be dismissed purely on the objection that it is unnatural. Charo and Greely (2015) take the case of what they call "CRISPR critters", which are animals created by a gene-editing technique, and ask whether they differ from unintentional human intervention. Oksanen (2014) points out we have been interfering with nature for a long time, and there is little nature left that has not been influenced by human impact. He claims that it is important for the protection of biodiversity that restored or newly created ecosystems are valuable and should receive protection. Because these systems are valuable, there are moral reasons for developing and using new techniques to protect these ecosystems.

3.4 Influence on ecosystems

Regarding the influence of de-extinct species on the ecosystems they are (re)introduced in, there are arguments both against and in favour of de-extinction. Some authors point at the risks of putting species back in ecosystems that have changed since this species went extinct or state that de-extinction is pointless if the original cause of the extinction is still there (Sherkow and Greely, 2013; Kasperbauer, 2017). Other authors argue for the benefits that bringing back certain keystone species could have for the ecosystem, for example, by fulfilling an essential ecological niche (Shapiro, 2016). De-extinction can also be a part of a broader conservation strategy (Adams, 2017; Turner, 2014). Not only directly as

an additional tool for conservation, but also by increasing public support for conservation (Adams, 2017).

Newly de-extinct animals could be vulnerable and be good carriers and transmitters of diseases (Sherkow and Greely, 2013). Species could do damage to the environment in different ways as well, even without carrying diseases. They could become invasive and cause a problematic imbalance in the ecosystem, as their original habitat has changed or has been lost, or their place in the ecosystem is taken over by other species (Sherkow and Greely, 2013). It is likely that we currently do not know enough about the consequences to avoid these risks. Kasperbauer (2017) argues that often, the original cause of extinction still exists. In the case of habitat loss, the risk of a species becoming invasive, becomes more significant, as it has to compete with other animals for habitat and food sources. Depending on the ecosystem and the role the de-extinct species is intended to fulfil, it could be ineffective to bring back only one species (Kasperbauer, 2017). Sandler (2013) argues that there are some cases in which the reintroduction of a single "keystone" species has had a major impact on the ecosystem as a whole, but states it is often unlikely that a single species focus will be effective. Nonetheless, even if not many ecosystems can be benefited from the reintroduction of just one species, it does not mean that they cannot be part of a broader restoration strategy. Moreover, this objection is not specific to de-extinction, as many current rewilding projects already use the strategy of reintroducing locally extinct species.

Another argument against de-extinction is that there is sometimes simply no environment to put recreated species back into, or the original cause of extinction is still there (Debating Science, 2013). However, there is no reason that the recreation of species cannot go hand in hand with the recreation of lost habitat. This is even preferable to avoid further loss of species diversity, as humans are the leading cause of species going extinct, we have control over our actions in order to prevent the extinction from happening again. Brand (2013) argues that bringing back well-selected species can help to restore ecological richness to the environment. Taking into account the interdependency of species, biodiversity is fundamental for our own needs, providing us with a great diversity of food, greater opportunity for medical discoveries and economic development, as well as having aesthetic and recreational value (Alonso, 2008). Furthermore, it can be argued that biodiversity is valuable for its own sake, having a certain intrinsic value.

On a scientific level, de-extinction can be valuable because it gives us the chance

to study previously lost species, or close replica's, for research purposes (Debating Science, 2013). This would not only bring us a greater understanding of life history and biology of ancient species but can also have practical value in preventing future extinctions (Cohen, 2014). Further scientific benefits would most likely include advancements in genetic engineering and biotechnology, with advances that will be applicable to many species, including humans (Cohen, 2014). New insights about the functions and evolution of species that went extinct can be provided by studying re-created living members of it, or at least members of a newly created species that strongly resembles it. If, for instance, new drugs are discovered and can be made from formerly extinct plant species, de-extinction could be useful for human purposes as well (Sherkow and Greely, 2013).

Until now, science involving de-extinction and conservation biology have been mostly going in separate directions, with little dialogue between them. The prospect of de-extinction, along with advancements of genetic technologies that might be used for conversation purposes, has recently launched a conversation about how they may intersect (Kaebnick & Jennings, 2017). Adams (2017) argues that these technologies can have benefits for conservation, such as helping species to adapt to climate change. An example put forward by Mascerelli (2014), is the use of genetic engineering to make coral species more tolerant to the rising water temperatures. Moreover, de-extinction can move conservation a step further towards restoration, not only conserving what is still here, but restoring what has already been lost.

The possibility of restoring lost species will increase the biodiversity that has been lost because of their extinction. Kasperbauer (2017) states that the project to bring back the passenger pigeon has the potential to "preserve biodiversity, to restore diminished ecosystems, to advance the science of preventing extinctions and to undo harm that humans have caused in the past" (Brand, 2013). This can used as an addition to the conservation strategy "rewilding". This strategy often includes the reintroduction of locally extinct species in particular habitats, as these species help restore ecosystems (Sherkow and Greely, 2013). The same can be argued about species that have gone entirely extinct as well, as there is little difference between locally or globally extinct species when reintroducing them into an ecosystem. Sherkow and Greely (2013) argue that the de-extinction of the woolly mammoth might help to transform a tundra, into a ecologically more rich artic steppe. As its place in the ecosystem is unique, it is a role only this species can fulfil. There is no reason that the recreation of species cannot be combined with the recreation of lost habitat. This might even be preferable to avoid further

loss of species diversity.

Turner (2014) argues that if the goal of restoration is the promotion of ecosystem health, de-extinction can be a useful strategy. He argues that promoting ecosystem health is, however important, not the only possible goal of restoration. De-extinction projects may serve multiple goals, such as having cultural or aesthetic aims, as well as to restore our relationship with non-human nature. Turner argues that the restorationist argument lends strong prima facie justification to local extinction reversal in the cases where it improves the health of the ecosystem, and because the difference between local and global extinction makes no difference to ecosystem health, the restorationist argument lends strong prima facie justification to global extinction reversal in some cases. He does take into consideration that although his argument would provide prima facie justification for reintroducing an extinct species, other concerns might override these justifications.

3.5 Moral hazard problem

Politically, the current protection of endangered species is very dependent on the argument of irreversibility (Sherkow and Greely, 2013). Preservation of species might become less of an issue when species can be brought back and extinction is no longer permanent. Why worry about the loss of populations and species when they can be easily be remanufactured in labs? The fundamental issue of changing human behaviour to tackle the current loss of biodiversity would not be challenged (Beattie & Ehrlich, 2013). Thinking about alternative solutions does not have to exclude current efforts to counter the extinction of species. Without any adaption of human behaviour, the newly resurrected species would go extinct again, wasting valuable effort and money. When arguing for de-extinction, it should be firmly embedded in current conservation efforts and be seen as an addition, rather than an individual solution. Another political consideration is that de-extinction projects are costly and might be a bad investment. Especially taking into consideration that the money spent could have been used to prevent other species from going extinct (Cohen, 2014). Ehrlich (2014) calls it “a ‘fascinating but dumb idea’ because it could distract from more pressing issues and cost-effective conservation actions.” De-extinction projects might not be the most cost-effective way to invest in biodiversity, but one could argue that technological developments are always expensive at first, but have to be further developed and more commonly used to be worthwhile.

Turner (2014) states that a lot of urgency to invest in the conservation of species, is caused by the realisation that extinction is irreversible. If we recognized that

the de-extinction of a species does not actually bring it back, but creates a more or less exact copy of this species, the danger of the moral hazard problem would become less. Avoiding this is important, because the idea that extinctions are reversible, could contribute to an even more increased loss of biodiversity. By seeing de-extinction as an opportunity to extend the possibilities of conservation, adding a new tool to the conservation tool-box so to speak, we will less easily fall into the trap of thinking we can recreate any species that we cause to go extinct. Considering that de-extinction projects are costly, have so far not been successful, will come with risks and difficulties when reintroducing these species, and do not solve the causes of extinction, a strong belief in reversibility of extinctions can be counter-productive to conservation efforts.

3.6 Aesthetic and recreational value

The last benefit of de-extinction Sherkow and Greely (2013) put forward is a factor of "wonder" or even "coolness" and they argue that this might be the most significant benefit of de-extinction. Most people are even more drawn to this argument than the argument of humanity having a certain obligation towards animals or species. Cohen (2014) states that the recreational value of de-extinction should be taken into account, as it would be "an exciting diversion" for many, to see charismatic megafauna.

Tanasescu (2016b) is not convinced by ecological or ethical reasons for de-extinction and states that proponents of de-extinction should focus on aesthetic arguments instead. Instead of claiming bringing back certain species is necessary, or arguing we are able to bring back the same animal, there may be an argument in the value we attribute to a copy or look-alike of an extinct species. Cohen (2014) argues that the increase of aesthetic value or “woundrousness of nature” can be recognized by environmental ethics. This can be comparable to the positive effect that natural parks or even zoos can have peoples attitude to animals and nature. Being able to see formerly extinct animals can give an enormous boost to the recreational value of a particular area or natural park. Monbiot (2013) states that by restoring or rewilding “we may bring wonder back into our lives”. This can help the local economy, but also protect these areas against exploitation, hunting, or other human activities that might harm this ecosystem.

Myhr and Myskja (2014) also put forward the related cultural value based on aesthetic appreciation of nature. People appreciate nature because it enables them to disengage from their usual activities and experience something different. This may take different forms, from mere aesthetic engagement, nature as a

place for physical exercise and challenges and direct engagement through fishing, hunting, and gathering (Myhr and Myskja, 2014). Although these later ones may have an economic aspect, or are in some cases even necessary for survival, for many people they are not essential activities. Moreover, the recreational value which be translated economic value as important parts of the tourism industry, still cannot be reduced to mere economic value. Because even if there would have been no organized tourism or there is no money made from these activities in other ways, people still appreciate nature for these reasons (Myhr & Myskja, 2014).

An important consequence of aesthetic consequence may be the selection of species. Although there are some objections against the selection of “charismatic megafauna” and this term even has a somewhat negative connotation (implying other, less charismatic, but ecological crucial species, may not be worth preserving), looking at the aesthetic and recreational value, it makes sense to give priority to charismatic megafauna. This may in turn lead to a new appreciation for nature and an increased importance to conservation projects. “It is a fact that we find some species more valuable than others because they play a more important role in our appreciation of nature, and that gives us grounds for special protection of these species”(Myhr & Myskja, 2014). In this sense, even when just taking into account anthropocentric arguments, conserving or restoring ecosystems and species can be much more than just preserving enough biodiversity to sustain future generations.

3.7 Implications

For the relation between the human and the non-human world, the most interesting motivations for de-extinction are the technological and scientific advancement, the possible benefits to the restoration of ecosystems and the aesthetical benefits, or “coolness factor”. As argued before, creating a look-alike species that can fulfil a specific role in an ecosystem would not be any kind of moral retribution, but doing it for the benefit of ecosystems, our scientific knowledge or simply because we think it is cool, can still be good reasons to de-extinct certain species. Tanasescu (2016b) argues that we should not obscure the underlying motivations for de-extinction by arguing from a certain moral duty. He does not only point at the dangers of the moral hazard problem but also states that this removes animal recreation from the public discussion that should inform it. Tanasescu (2016b) argues that de-extinction should be a social phenomenon, just like extinction. This makes sense, especially if we look at the aesthetic value compared to the natural "need" to bring back certain animals. Because the risks we are willing to take and the possible benefits we value depend on the way we

regard nature, this makes decisions regarding de-extinction a political issue.

After we have determined what possible motivations for de-extinction are and whether they hold up, we should determine if they would fit in, or lead to, a society we desire. De-extinction projects would have enormous implications for the way we can, and probably will, interact and intervene with nature. So while some arguments in favour of these projects seem very compelling, we should further consider if this is the direction we would want to go in as a society.

Chapter 4: Green society

Environmental ethics concerns the ethical relationship of human beings with the natural environment. What, if any, duties do humans have with respect to the environment, and why? Although there is a growing awareness of environmental problems and an increasing consensus at least some changes to our current society should be made, there are many different perspectives on how to do this. These differences mainly originate from various ethical and metaphysical questions, like the exact status of the ecological system and the role of humans in it. Wissenburg (2008) explains that the main disagreement is on whose interests are to be taken into account: just those of humans (along with future generations), also including non-human animals, or even life in general. According to Curry (2006), one of the main topics of discussion environmental political philosophy is with expressing what is ethically important about the non-human world and how it should be (intellectually) defended and protected. These different perspectives are incredibly relevant for political decision making regarding human interference in nature, and the way our society is organised. Different perceptions and interpretations cause difficulties in reaching a possible consensus. The ethical issues arising from (bio)technological advancements are not merely a matter of weighing the benefits to possible risks, but also of asking what these developments will mean for our society (Myhr & Myskja, 2014).

De-extinction as a conservation strategy could be part of rewilding practices, as an addition to current possibilities to reintroduce species. The choices of species to reintroduce would no longer be limited to locally extinct species but can include globally extinct species as well. The Oostvaardersplassen in the Netherlands was the first European rewilding project that incorporated the reintroduction of the back-bred Heck cattle, which were meant to resemble the extinct aurochs (Eshel, 2014). This chapter will first briefly discuss rewilding as a conservation strategy and then consider different perspectives offering various “green” alternatives to our current society, specifically regarding the transition required to get to these alternatives. Although rewilding is usually presented as a new way of nature conservation, it may offer a view on society in which people live alongside nature and wildlife, and different understandings of rewilding of both nature and humanity may offer diverse ethical and political possibilities. After the concept of rewilding, this chapter includes different schools of green political thought, starting with deep ecology, also referred to as ecologism in the strict sense, and environmentalism, which takes a more anthropocentric approach. These positions will be presented as opposites, as done in much of the environmental philosophy literature. However, it is essential to realise there are many different positions in between them, and even within the various approaches, a surprising variety of perspectives can still be found. This will be highlighted by ecological pragmatism, which refuses to take a stance between ecologism and environmentalism but instead seeks to integrate the two regarding a practical solution to environmental issues. Then, a modernistic society based on the ideas of ecomodernism is discussed. Ecomodernism has been a relatively new addition to environmental philosophy, as it emerged in 2015 with the publication of “an ecomodernist manifesto”.

4.1 Rewilding

Rewilding is presented as an ambitious and relatively new alternative to current approaches to nature conservation. A common of rewilding aim is to maintain, or preferably increase biodiversity, while simultaneously reducing the impact of both present and future human interventions (Lorimer et al., 2015). Although generally being promoted as a conservation tool, and so far applied in more or less successful projects all over the world, with concentrations in Europe, North America and on various tropical islands, it can also be interpreted as a broader political strategy for reshaping our society. While focusing on de-extinction, rewilding can provide valuable insights, as it often includes the reintroduction of locally extinct or endangered species. Aside from additional ethical issues arising from the development and the application of bio-technologies, in practice, there may be little difference in reintroducing locally or globally extinct species.

The term rewilding originates from conservation biology, in which rewilding is proposed in order to limit the loss of biodiversity, often caused by humanity. From this perspective, the “wild” is nature that is untouched by humans and populated by a variety of wild animals, including essential predators (Bauer, n.d.). It builds on assumptions usually found within other conservation strategies, which consider humans to harm nature generally. Although wild and untouched nature is valued, rewilding may also include the creation of “novel” ecosystems. Tanasescu (2016a) defines novel ecosystems to be a place which is either directly or indirectly influenced by human activity, and it contains elements that would not have come together without this initial interference. Depending on the approach taken, these ecosystems can be preserved through active management or can exist without further human interference, so it can develop naturally in ways that would not have been possible (Tanasescu, 2016a).

Rewilding as a restoration strategy to enhance the conservation of biodiversity is quickly emerging. It aims to promote self-regulating ecosystems in our current human-dominated world while re-engaging people with nature (Lorimer et al., 2015). Rewilding Europe (n.d.) states this strategy is about letting nature take care of itself and enable natural processes to repair and restore damaged ecosystems and degraded landscapes. By giving a helping hand and creating the right conditions, faith is put in nature to manage itself and therefore creating, or restoring, habitats with more biodiversity. As wildlife species have sharply declined or even gone (locally) extinct, advocates of rewilding strategies believe it is of vital importance to reintroduce lost species by giving them the space to thrive (Rewilding Europe, n.d.). As it is becoming increasingly influential in restoring ecology and conservation science, rewilding is now viewed as a possible pathway a society can take towards sustainability. The reason for this is that it is supposed to have the potential to be beneficial to both the human and the non-human world that extends beyond traditional natural heritage conservation (Lorimer et al., 2015).

Jepson (2015) argues that rewilding is an interesting and experimental approach that is hard to define, leads to outcomes that are hard to predict, but are generally speaking driven by a strong faith in passive management, new socio-economic opportunities and the return of wildlife to the newly established ecosystems. The term rewilding has initially been “founded” by the Wildlands Project in 1991, but was based on related ideas already originating from the 1960s (Pellis & de Jong, 2016). Jørgensen (2014) states that rewilding represents an alternative strategy to traditional conservation, that suggests “to make wild again” (p. 1). Hintz (2007) adds to this that pre-human baselines are often hinted

at within rewilding discourses. There are many interpretations of rewilding, consisting of different strategies that can be understood and put in practice in various ways. Generally speaking, rewilding has two distinct origins, namely from Europe and the United states (Pellis & de Jong, 2016). Soulé & Noss (1998) define American rewilding as “the protection or restoration of the full suite of native predators to ecosystems, thereby restoring self-regulating land communities” (p. 23).

Pellis and de Jong (2016) argue that European rewilding varies from the American understanding in the way that wildness is perceived differently, and there are differences in managing. They state that the roots of the underlying social construct of wildness seem to be European. Hall (2014) describes these perceptional differences as “Americans extracting culture” and “Europeans injecting nature”. In other words, Europeans seem to accept more human involvement in nature, while wildness in the United States is generally only accepted without any human presence (Pellis & de Jong, 2016). The focus in the United States seems to be more on restoring megafauna to unoccupied areas, while European rewilding aims at drastically transforming ecosystems, like former farmland, to create a novel ecosystem which we perceive as healthy, wild and diverse. This is an oversimplification based on two separate origins, and current and future projects will most likely contain elements of both, depending on the currently existing state, rather than continental differences.

The desire to recreate lost nature or create novel ecosystems can have different reasons. Besides the more obvious ecological aims of these projects, like increasing biodiversity, protecting endangered species or restoring balance in existing ecosystems, rewilding projects may also have scientific, aesthetic, economic or social benefits. This is in line with some of the potential benefits of de-extinction as elaborated upon in Chapter 3. Moreover, it is worth noting that rewilding shows a complex paradox regarding environmental agency. On the one hand, it shows a desire to restore natural processes, with little interference of humans, on the other hand, these natural processes are created or restored according to our vision (Eshel, 2014). We decide which ecosystems we consider worth restoring or creating, and which species should be reintroduced where. So while it can be meant to re-create a stable lost wilderness, rewilding can turn out to be a process of redesigning and having control over non-human nature.

Different interpretations of rewilding can be seen in the various societies inspired by environmental thought, which will be discussed in the following. Approaches that will lead to a primitive, sustainable or (eco)modernist society are discussed,

as well as ecological pragmatism, which seeks to find an intermediary position between ecologism and environmentalism.

4.2 Primitive society

The latter half of the twentieth century saw the emerge of two types of environmentalism: environmentalism, and ecologism, or “deep ecology”. The terms environmentalism and ecologism are often used interchangeably, but it is more accurate and useful to regard ecologism as a philosophy that believes that a fundamental transformation of society is needed, whereas environmentalism believes that threats to the environment can be tackled within the existing political, economic and cultural order (Dobson, 2007). In this part, ecologism is discussed as a basis for a more primitive society. Ecologism strives for a radical reform of our current society, sets limits to (economic) growth and defends a reduction of the population and the protection of nature against every form of irreversible destruction (Wissenburg, 2008). Dobson explains that this is different from the more pragmatic “limits to growth” arguments. Humanity should not just be concerned about the limitations of resources for human use and what would happen to our lives if these resources are run down. Dobson (2007) stresses that “even if resources were infinite, there might still be a good reason not to treat the non-human world in a purely instrumental fashion” (Dobson, 2007, p. 29).

In 1973, the Norwegian philosopher Arne Naess first described deep ecology in a brief article “The shallow and deep long-range ecology movement”, although the subsequent development of this perspective was influenced by two Californian scholars, philosopher George Sessions and sociologist Bill Devall. Deep ecology supports many of the same goals as environmentalism, but seeks to “explicitly incorporate the environment into the daily lives, thoughts, and political and moral compasses of citizens, nation-states, governments, and communities alike” (Welker, 2013, pp. 9). Deep ecology is an ecocentric and holistic approach promoting the intrinsic value of nature, regardless of the instrumental value for humans. It argues against human interference with the natural world or its destruction, based on respect for the value of non-human life itself, rather than considering the implications for humanity. Naess (1973) differentiates between ‘shallow’ and ‘deep’ ecology, and his starting premise is the attack of environmentalism, which he defines as shallow ecology. He states it focuses on minor changes to the way of life in the West (1973). In this article, the author claims that the foundation for a more fundamental shift can be based on Deep ecology, because it does not aim to merely cure the symptoms, but seeks to address the primary causes of environmental problems.

Deep ecology offers a radically different perspective compared to the current social paradigm (Devall, 1980). The dominant social paradigm sets the cultural context, which defines the world views of the members of its society. Milbrath (1984) has defined this dominant paradigm as “the values, metaphysical beliefs, institutions, habits, etc. that collectively provide social lenses through which individuals and groups interpret their social world” (p. 7). As an example of some of the assumptions that deep ecology challenges, Devall (1980) gives the value of the growth of the economy. Devall (1980) argues that North America’s dominant paradigm involves the belief that “economic growth” is a measure of progress. Within this paradigm, nature is only seen as a resource to this goal. Therefore, Naess (1995) argues that to accomplish a more fundamental change, there needs to be a focus on ontology. He states we should question how humanity and non-human nature, and the relationship between the two ought to be defined. There are variations in beliefs within deep ecology, but generally, the emphasis on these causes and ontology can be viewed as two core elements. Focus on ontological understanding essential, as most disagreements regarding non-human nature are not caused by differences in moral perspectives and beliefs (Katz, 2000), but rather from differences in world views. Instead, it is an environmental ontology that will allow for the necessary modifications in the way we presently treat non-human nature. The ontology put forward by deep ecology indicates that humans and non-human nature are interrelated and humans are comparable to non-human animals, this realisation will result in an increased appreciation for that nature.

Deep ecology does not necessarily present a clearly defined philosophy but presents eight principles which are deliberately broad and show a plurality of the different viewpoints being offered. Naess wrote that: “the articulation of our views is, and must be, fragmentary” (1995). Naess and Sessions (1984) summarise their ideas in eight principles, which can be summarised with three simple propositions: Preservation of biodiversity and wildlife, control (and ultimately the reduction of) the human population and a more primitive way of living, which should decrease the influence we have on Earth’s natural resources. Naess perceives deep ecology as a total view, which remains open to a constant dialogue, so the development of deep ecology is an ongoing process.

Aaltola (2010) describes deep ecology as an environmental philosophy that seeks to change the relationship humans have with the non-human world, by reinventing humanity within nature, rather than positioning them outside of it. Central to this philosophy is the concept of “biospherical egalitarianism”, which states that all natural beings are interconnected, and they should be taken into

account equally. Deep ecology goes further than any other eco-political theory in its conceptions regarding the way nature should be included in political decision-making. These processes should incorporate the concept of intrinsic value, as “all biological entities and ecosystems possess an equal right to fulfil their vital needs and flourish to their fullest potential regardless of the instrumental value that these other beings provide to humanity” (Naess, 1986).

Deep ecology advocates radical cultural change as a way of transitioning to a more ecocentric society. Within such a society, to create more ecologically sustainable communities, humans should pursue harmonisation with nature (Eckersley, 1992). Wissenburg (2008) states that although most “green” theories of the ecologically good society defend life in accordance with nature, ecologism is different because it defends a society that is rearranged as a part of nature.
The term rewilding is first and foremost a conservation strategy and is usually not interested in how humans lived as hunter-gatherers before the Anthropocene, the term rewilding simultaneously arose within (anarcho-)primitivism, as criticism on our current society (Bauer, n.d.). Mostly associated with green anarchy and primitivism, this type of rewilding sees civilisation as an inherently destructive force and is critical of the current dominant social paradigm. In the early 2000’s proponents of these ideas, most notably John Zerzan, published a magazine called “Green Anarchy” which focused on anarcho-primitivism and rewilding. This perspective took rewilding further than just a conservation strategy and criticised the root causes of extinctions caused by humanity. Bauer (n.d.) states that these two ideas are not that far off from each other and believes that they will merge over time, making rewilding a political theory, as well as a conservation strategy.

Zerzan (2002) defends primitivism, usually seen as a sub-type of deep ecology, and claims that the core elements of contemporary civilisation are to blame for current social and environmental problems. The author argues that two elements cause the issues facing modern society: domestication and mediation. He claims that domestication has deprived the value and agency of both humans and non-human animals, reducing them to entities which can be controlled by forces of capitalism and anthropocentrism (Zerzan, 2002). Mediations like language, numbers, time, and art, are the bases of our modern society and have also resulted in the loss of value. By replacing what is real with social constructions, humans are alienated from themselves and their surroundings. Zerzan (2002) argues that humanity should go back to their “first nature”, as this state of being was free from mediation and therefore more authentic. Other thinkers like John Filiss (n.d.) also emphasis a loss of authenticity; however, although he follows Zerzan in his emphasis on alienation, he blames it on technology. “Perhaps the

easiest way to understand primitivism is as a counterweight to the pull of technology" (Filiss, n.d.).

4.2 Sustainable society

Similarly to ecologism, environmentalism addresses environmental, political, and social issues and treat them as interconnected (Wissenburg, 2008). Environmentalism and ecologism deviate on some essential points, which will be discussed in the upcoming section. Like ecologism, environmentalism defends the protection of nature from excessive human deprivation. Environmentalism is, as opposed to ecologism, an anthropocentric approach, rather than ecocentric or biocentric. This means that humans are seen as the only, or at least primary, holders of moral standing. Environmentalism also seeks to extend a moral standing beyond presently existing human beings (Wissenburg, 2008). Where ecologism does this by taking into account the whole non-human world, environmentalism usually includes the interests of future generations as well (Wissenburg, 2008). This anthropocentric view is most clearly seen in the advocacy for sustainable use of natural resources, to make sure a shortage of resources does not disadvantage future generations, preservation of nature for human pleasure must also be seen as anthropocentric. Wissenburg (2008) states that this anthropocentric view is usually defended by pointing out the differences between humans and the non-human world: "[…] only humans (or intelligent beings) have a conscience, are capable of moral action, can plan and act on intention, and are therefore responsible creatures. Other creatures, animals in particular, are thought of as not having a self, a good "of their own," a consciousness of right and wrong. Their value is, therefore, purely instrumental: it depends on what humans value them for" (Wissenburg, 2008).

Beckmann et al. (1997) write that essential to the anthropocentric dimension is the belief that humanity and nature are separate spheres, and humans are ethically superior to the rest of nature. Ecologism, on the other hand, builds on the firm conviction that this anthropocentrism is ethically wrong, and is the current ecological problems. (Kopnina et al., 2018). Dobson (2007), however, makes a distinction between weak and strong anthropocentrism, or, in other words between human-centred and human-instrumental anthropocentrism. "I want to suggest that anthropocentrism in the weak sense is an unavoidable feature of the human condition, while the strong sense carries a notion of the injustice and unfairness involved in the instrumental use of the non-human world" (Dobson, 2007, p.44). Hayward (1997) argues that since we need healthy ecosystems for our survival, some degree of anthropocentrism can and should be a powerful motivation to protect the environment from further degradation.

Some authors, such as Norton (1984) have argued that weak anthropocentrism is inevitable, and can even turn out to have a positive influence on environmental protection (Norton, 1984). Dobson (2007), a proponent of ecologism, argues that anthropocentric arguments can be useful for political purposes and be more convincing for a broader audience. Many arguments that are used by green parties are anthropocentric, even if they are founded and act on ecologist ideals. Environmental degradation and loss of biodiversity are related to health risks to humans, and people are made aware of the way our society would change and how this might affect our welfare, if we would not protect the environment, or if we would run out of resources. By taking this approach and rejecting the intrinsic value of non-human nature, environmental protection is only needed to the extent that safeguards our own well-being (Borràs, 2016).

Environmentalism is usually presented without a clear political or ideological agenda. Dobson (2007) even describes environmentalism as "a managerial approach to the environment within the context of present political and economic practices" (p. 2). Compared to ecologism, environmentalism is less radical in the reforms they believe are needed to shape a more sustainable society, taking nature's continuous ability to renew itself as a minimum requirement. Environmentalists, or 'light greens', believe that change must and can come from within the present system, put forward by green political parties, or social groups. For example, through regulations, tax changes, and reduced/more sustainable economic growth (Harisson & Boyd, 2018). "Environmentalists do not necessarily subscribe to the limits to growth thesis, nor do they typically seek to dismantle industrialism" (Dobson, 2007, p. 26). Although both perspectives believe in some limits to growth, this is usually interpreted by environmentalism as a need for "sustainable" growth. As Dobson (2007) points out, environmentalists and ecologists share the goal of counteracting or restoring environmental degradation, but their strategies to get to a solution differ considerably.

Environmentalism is an anthropocentric approach, which receives criticism from ecology movements that consider themselves "deep green" while referring to environmentalism as a "shallow" movement. However, distinguishing between ecologism and environmentalism as done in much literature might not be useful when considering practical issues. Plumwood (2006) argues that environmental issues show that many affect or involve both human beings and non-human nature, in ways which show their interconnectedness. Other authors also point out that ecologism and environmentalism may differ theoretically, but are often reconcilable in practice. Although starting from different positions,

environmentalists policies more often realise the aims of ecologism rather than contradict them (Wissenburg, 2008). Acknowledgement of the way humans and non-human nature is interconnected, rather than seeing them as separate spheres, is key to this approach. Bookchin (1982) refuses to choose between anthropocentrism and biocentrism, putting forward social ecology as a theory about the relationship between ecological and social issues. Ecological pragmatism does not choose between the two and instead distinguishes between strong and weak anthropocentrism. Norton (1986) claims that only weak anthropocentrism is capable of taking into account the diversity of instrumental values that humans may derive from the natural world. Therefore, ecological pragmatism is discussed in this chapter as part of environmentalism, as it takes a (weak) anthropocentric stance, while it recognises that satisfying human interest does not necessarily need to involve the irreversible destruction of nature.

Rejecting the value of non-human nature, or destruction of nature to satisfy our needs is in no way central or essential to environmentalism. By taking this approach, not only a middle ground between the two is taken; more importantly, it leaves room for taking into consideration more than just instrumental value. Norton (1986) distinguishes between direct satisfaction of human needs by consumption or otherwise use of natural goods, and a value that (derives?) from aesthetic, moral, spiritual or scientific value for humanity. With this understanding, ecological pragmatism is not merely being a midpoint between the two, supporting either an instrumental or intrinsic value of nature, but rather puts forward a value that can not easily be reduced to either one of these categories. Norton suggests accepting the plurality of natural values and placing them on a continuum, ranging from, for example, consumer and economic values, to aesthetic or spiritual values. In this part, environmentalism is regarded as human-centred, rather than human instrumental. Seeing environmental, political and social issues as interconnected.

By taking this intermediary position, both anthropocentrism based on the originally religious principle that the Earth was made to be dominated by humanity and the biocentric view that turns humans into merely another community of animals can be rejected (Bookchin, 1991). Moreover, by separating ecological problems from social issues, we would misconceive the source of the growing environmental crisis (Zimmerman, 1993). Calling for a collective effort to change society ecological pragmatism assumes both environmentalism and ecologism will lead to similar practical outcomes (Norton, 1984). Hayward (1997) argues that the realisation that many ecosystems and other parts of the non-human world are our “life-support system” on which we strongly depend will

ultimately lead to its protection.

4.4 Ecomodernist society

In April 2015, a group of ecomodernist wrote: “An ecomodernist Manifesto” (Asafu-Adjaye et al., 2015). Ecomodernism is an environmental philosophy that argues that for human protection of nature with the use of technology, to thereby “decouple” human impacts from the natural world. Although ecomodernist do recognise existing environmental problems, they believe in the possibility to minimise, or even solve these problems, with the help of human inventions. By using science, technological advancements, and development, ecomodernism argues that human impacts on the natural world can be “decoupled” from economic activity (Monbiot, 2015). Decoupling can be explained in absolute and relative terms. Relative decoupling entails that anthropocentric impacts on the environment rise slower than the growth rate of the economy. Absolute decoupling occurs, however, when the total impact on the environment peaks and begins to decline, even while the economy still grows (Asafu-Adjaye et al., 2015). Ecomodernists argue that in this way, it is possible to increase the standard of living of humanity while doing less damage to the environment than we are currently doing (Monbiot, 2015). As ecomodernist do not see nature as intrinsically valuable and have no problem with human dominance, it is an anthropocentric theory. With regards to non-human nature, ecomodernism represents a “philosophical shift from the management of nature to the liberation of nature” (Symons & Karlsson, 2015).

Ecomodernism expects in the short term a lot of technological innovations, for example, technological advancements in energy, which will contribute to a new and more sustainable economy. “Knowledge and technology, applied with wisdom, might allow for a good, or even great, Anthropocene”, the authors of the Ecomodernist Manifesto (2015) argue. “In this, we affirm one long-standing environmental ideal, that humanity must shrink its impacts on the environment to make more room for nature, while we reject another, that human societies must harmonise with nature to avoid economic and ecological collapse” (Asafu-Adjaye et al., 2015). They argue that these two ideas can no longer be reconciled. Because they think that the economy can be completely sustainable, they do not see a problem in economic growth, but rather as a positive contribution to the rise of the standard of living. By intensifying many human activities, like changing the way we generate energy, or switching to more intensive agriculture in a way that uses less land and interferes less with the natural world is key to decoupling human development and economic growth from nature (Asafu-Adjaye et al., 2015). Second, is a shift from the management of nature to its liberation.

Contrary to more traditional environmental philosophies, ecomodernists argue for a separation of humanity from the environment and planetary-scale rewilding. They claim humans have historically only spared nature for which they have little practical use (Blomqvist, Nordhaus & Shellenberger, 2015). While many of the concerns of environmentalism and ecologism are shared, the ideal of harmonising with nature in some way is rejected. To decrease our impact, instead, argue for further separation from nature via technological innovation.

For traditional environmentalism, human exceptionalism means that humans can avoid extinction by self-regulating their resource use and reproduction rates, unlike any other species. Karlsson (2019) however, argues that for ecomodernism this human exceptionalism requires the completion of the emancipation from nature, a process which has begun with the Enlightenment. The author states that ecomodernism promises "[..] a democratic and pluralist future characterised by ever greater measures of fluidity whereas traditional environmentalism seeks to restore a common sense of belonging and permanence" (Karlsson, 2019, p. 11). However, although ecomodernists are critical towards these ideal types, both ecomodernists and traditional environmentalists agree that before things get any better, they will probably get significantly worse first.

"In contrast to the more anti-modern strands of radical environmentalism, ecomodernism is often characterised as an optimistic doctrine" (Smaje, 2015). It was well-received by the media because what they say fits with the current dominant political and economic narratives. However, although leading ecologists used to be hostile towards technology (van der Hoeven, 2015), few environmentalists would argue against the improvement of renewable energy technologies and reducing demand is no longer seen as the only way to mitigate climate change (Nijhuis, 2015). "Conservation requires conversation; protecting nature while still using it to meet human needs is a paradoxical mission, and its methods depend heavily on time and place" (Nijhuis, 2015).

By outlining the different environmental perspectives, and the green alternatives they offer to our current society, it becomes clear in which aspects they differ and which aspects they share. While the differences in philosophical positions are significant, many policies serve similar goals. To deal with the urgency of environmental problems, such as the degradation of ecosystems and the loss of biodiversity, we need to decide what risks we should and want to take. Fundamental changes to our current society may not be politically viable in the short term; this is true for both primitivism and ecomodernism. While approaches such as environmentalism and ecological pragmatism offer more room for de-

extinction, they also come with their own problems and risks.

Chapter 5: Possibilities and risks

This chapter will review the alternative societies discussed in Chapter 4 in terms of possibilities and the risks they present. Which one is most realistic and which can incorporate de-extinction in their transition to a more eco-friendly society? Either as part of rewilding as a conservation tool, by serving some of the other benefits, such as scientific and aesthetic advantages. Each society will be presented in the context of rewilding, to which de-extinction could make a useful addition. The order in which they will be discussed is different compared to the previous chapter, as the primitive and (eco)modernist societies offer the least room for de-extinction, or require a more radical change from our current society, making them less politically viable. Then this chapter will discuss ecological pragmatism as part of a society based on an environmentalist approach because it leaves room to incorporate both anthropocentric as well as ecocentric arguments. This chapter concludes with elaborating upon the precautionary principle and investigates whether this concept is useful for dealing with the risks to the environment posed by de-extinction projects.

5.1 Primitive society

Deep ecology has been used to support ideas familiar to primitivism. This approach begins with unity rather than dualism, which has been the dominant theme of Western philosophy (Devall, 1980). Ecologism has been predominantly critical of “anthropocentrism”, the view that human beings are central in the scope of environmental ethics, and only human beings have intrinsic value and rights. Different kinds of counter approaches are formulated; one of them is “ecocentrism”. Ecocentrism is the view that various trans-organismic entities, such as whole species, biotic communities and ecosystems have intrinsic value and because of this, also some basis of moral consideration, if not rights (Calliot & Fanning, 2017). As presented in Chapter 4, primitivism can be understood as a type of rewilding, as it aims to rewild both nature and humans, placing humanity within nature, rather than outside it. Devall (1980) presents deep ecology as a “person-in-nature”, which sees humans as not standing above or outside nature, but as a part of a creation or process which is on-going. Humanity should care for nature, and show reverence and respect for non-human nature. Non-human nature should follow separate evolutionary destinies, independent from humanities influence. By restructuring modern human society according to the ideas put forward by deep ecology, humans become part of nature. However, as this is a different understanding of rewilding, there is little room for human

interference in nature. Rather it aims at a broader identification with nature, thereby creating ecologically suitable communities.

Although human-caused extinctions already are human interferences in nature in several ways, choosing which species to de-extinct and to genetically modify these, interferes with the evolutionary development of species to an even further extent. Zerzan (2002) states that the elements central to contemporary civilisation are causing current social and environmental problems. Our current society needs to change, and we can not keep living the same way and solve problems with a technological fix. Moreover, as mentioned in Chapter 4, humanity should go back to their "first nature", which is free from mediation. Fillis (2008) blames technology for a loss of authenticity, as it alienates us from nature and empties both non-human nature and humans from their intrinsic value.

Cohen (2014) also discusses the ecologists view on the intrinsic value of nature and all living things, regardless of their instrumental value to humans, stating this value is often used as an argument against de-extinction. Cohen presents the argument as follows: "Humans cannot restore natural intrinsic value, since all restoration is, qua human creation, artefactual – the precise antonym of the natural" (Cohen, 2014, p. 167). Because the value of the "artefact" recreated is instrumental for the human purpose, it per definition loses its intrinsic value. He adds to this: "One cannot manipulate nature in order to preserve its autonomy; yet only as autonomous is it intrinsically valuable" (Cohen, 2014, p. 167). In response to this criticism, he formulates a critique to de-construct the sharp dichotomy between humans and nature.

Ecologists argue that humans are part of nature, so by that definition, it could be argued that human intervention is natural too, creating a paradox. Cohen states this understanding is an exaggeration, but that a sharp dichotomy between humans and non-human nature is exaggerated too. Cohen (2014) points out that even though artefacts created by de-extinction are caused by human activity, as long as they are not tools for human purposes, they can preserve a sense of autonomy for nature. Westra (1994) states that the most critical stance towards the creation and introduction of (locally) extinct species may be that they are an "intrusion upon the integrity of natural ecosystems". Oksanen (2014) also argues that de-extinct species are often less valued because of their unnatural origins. Moreover, he points to the influence these species might have on the biodiversity. The overall biodiversity might actually decrease, as new species might displace native ones. But even if these negative consequences do not occur, ecologists might claim that the wrongness is related to the technology used, or that

introduced species will most likely affect the ecosystem in some way, perceiving this as something unnatural, and therefore negative.

5.1.1 Risks

As a relatively new ideology, ecologism is still vague about how to move from our current society to their desired one. This perspective is not just a pragmatic, short term social movement with a specific goal like stopping nuclear power or fighting ocean pollution; it instead presents alternatives to broad conventional ways of thinking in the modern West. It seeks a transformation of values and social organisation, which requires a new paradigm and a new Utopian vision of “right livelihood” and “the good society” (Devall, 1980). This makes a transition to a primitive society challenging to realise. Harisson and Boyd (2018) compare the state of this ideology with nineteenth-century Marxism. This comparison seems somewhat fitting, as they both present a strong critical analysis of our society, but a weak theory that can lead to transformation. This makes deep ecology useful for examining the problems of the current society but does not necessarily provide enough tools to make it politically viable. “Perhaps the most striking feature of environmental philosophy is its failure to make itself practical” (Light & de Shalit, 2003). While this generalization certainly does not hold up for all theories within environmental philosophy, it seems to be a fair criticism to ecologism. With current green political parties remaining small in most countries, it is indeed hard to imagine a transition to a primitive society. Especially considering this type of society would demand a serious decline in the human population, making this transition a long and slow process, during which we will most likely lose even more species, before reaching a more eco-friendly state.

More alarmingly, Harisson and Boyd (2018) state that “it might be argued that the full implementation of a green agenda would be possible only under a highly authoritarian political system”. This would include cutting down the human population to about one-seventh of our current population. This would, in the best-case scenario, mean far-reaching birth control (only resulting in a relatively slow drop in population size). Wissenburg (2008) argues this way of life is not as environmentally friendly as it is often presented to be. Natural methods are often more polluting than modern technological solutions but do require a modern and technological society (Wissenburg, 2008). A significantly decreased population is a requirement for primitivism to be a more environmentally friendly society, but without actively killing a significant portion of our own species, we will most likely not see much results until it may be already too late. Wissenburg (2008) states that the ecologism perspective became a bit less attractive to people because of two reasons. These are the aforementioned practical problems and the fact that

many people do not want to go “back to nature”.

Overall, transitioning to a primitive society which is less polluting than our current one requires a relatively long time considering the rate with which we are losing species. The principles of deep ecology can be seen as a type of rewilding, which leaves little room for human interference, but rather includes “human rewilding”. De-extinction requires much human interference, further influences the natural evolutionary development of species and requires technology, which is seen as a harmful mediator, alienating us from nature. These types of criticism inspired some pragmatists, like Bryan Norton (1984), to defend ecologism with more anthropocentric arguments, to gain broader public support (see §5.3)

5.2 Ecomodernist society

The statement that earth is a human planet seems to become more accurate every day. There is little to no pristine nature left in the Anthropocene. Unlike most environmental philosophies, eco-modernists argue against calls for sobriety to protect non-human nature. Humanity is not required to change to a more primitive way of living. On the contrary, ecomodernist embrace developments that lead to agricultural intensification, genetically modified foods, urbanisation, nuclear power plants, and the development of advanced renewable energy sources. Key to these goals is the belief that further modernisation will eventually lead to a sustainable society, while simultaneously making more room for wild nature.

Ecomodernism is built on the belief that human technologies have made humans less dependent on the ecosystems on which we used to rely (Asafu-Adjaye et al., 2015). Ecomodernists believe that technology is the solution, not the problem. However, this does not necessarily mean that de-extinction would be a fitting solution to biodiversity loss within the eco-modernist approach. While traditional environmentalism seeks to re-embed society in nature, ecomodernism advocates greater separation as a way of enabling planetary-scale rewilding.

Much of the criticism of traditional environmentalism and ecologism often comes down to debates over scale (Symons & Karlsson, 2015). Crist (2018) argues it is not surprising that our natural impulse is one of scaling back or thinking we can unmake modernity and harmonise our society with non-human nature. Karlsson (2019) explains that this impulse of scaling down is fundamentally wrong. Ecomodernists argue that alternatives offered by ecologists are more land-intensive and state that these practices are incompatible with a world in which up to 10 billion people can live modern lives (Symons & Karlsson, 2015). Ridley

(2015) states that the eco-modernists argue that the ecologist approach, by seeking to live in harmony with nature, is making a mistake. They argue that attempting to harmonise or “recouple” humanity to the natural world will lead to an environmental disaster if a “massive human die-off” remains absent. If the human population stays equal to the current size, or even increases, this number of hunter-gatherers or primitive farmers would devastate the planet. Ecomodernists state we should instead shrink our impacts on the environment and leave more room for nature, by intensifying many human activities, resulting in a decrease of land use and meanwhile and interfere less with the natural world.

According to eco-modernist, traditional environmentalists, and primarily ecologists, are too critical about the effects of modernity and technology advancement for the environment. They are too cynical about the role of humans in relation to nature and think too much in terms of limiting humans in their actions. Instead, ecomodernists offer an alternative, based on the firm belief that only more technological advancements and breakthrough innovation can lead to climate stability (Symons & Karlsson, 2015). These authors argue that this technological innovation would be able to overcome the current “political and cultural polarisation surrounding climate change” (Symons & Karlsson, 2015). Karlsson (2019) describes ecomodernism as a progressive and humanist vision of the future. Ecomodernism suggests that only by accelerating the modernisation, it will be possible to meet global human needs while restoring an ecologically vibrant planet (Karlsson, 2019). With regard to non-human nature, ecomodernism represents a “philosophical shift from the management of nature to the liberation of nature” (Symons & Karlsson, 2015). This liberation would happen through large scale urbanisation, as humanity would live more concentrated, we would leave more room for nature. Lorimer and Driessen (2016) state that the protection of the natural world requires significant spatial decoupling of humans from nature. Rather than aiming for harmonisation with nature, as seen within ecologism, the land is set aside for the natural processes that serve human needs (Lorimer and Driessen, 2016). Technology is not used to conquer nature, but to leave more room for nature. If we can provide ourselves in our needs in a smaller part of the planet, then nature can have the rest.

Eco-modernists believe that many of the existing conservation strategies do not work. Although rewilding is a popular theme in other environmentalist approaches as well, ecomodernists believe that without technology, it can only be achieved with a massive decrease in population size. With technology, we can make more efficient use of land, so more land can be liberated. Moreover, as there is “no singular baseline to which nature might be returned” (Lomirer & Driessen, 2016)

and what survives or is created, is per definition a human decision. Within the ecomodernist approach, this objection is not relevant, so concerning the creation of novel ecosystems, it leaves more room for rewilding and de-extinction than ecologism.

5.2.1 Risks

In some respects, ecomodernism is a challenging and somewhat provocative new addition to the environmental debate, which is at least able to fuel some new discussion. It makes us think about ways to make the best possible use of (bio)technology as we can, and not a priori rule it out as an option to benefit non-human nature. It could break the current paradigm in traditional environmentalism, in which technology is usually seen as something harmful to nature. That being said, ecomodernism also received much criticism. It has many problems, such as not accounting for global inequality and democracy. Although this thesis only focuses on the environmental impacts, specifically regarding biodiversity, it is worth noting that it fails to take into account what ecomodernism might mean for existing farmers and other occupants of the land. Pearce (2013) even states that they “seem likely to become victims of the mother of all land grabs, whether for industrial agriculture or rewilding”.

Understood as the liberation of nature, rewilding within eco-modernism would be more in line with the American approach, as distinguished from European rewilding. The American approach is characterised by a more hands-off approach to rewilding, rather than active management of rewilded areas. De-extinction will most likely require active management, at least in the initial development phases of the technique as a conservation tool. While other species may be able to thrive if left alone after reintroduction, this will most likely not be the case for de-extinct species. As the product of a new technology, they will probably require active management, research and monitoring for future development, as well as risk minimisation. Especially when taking into account the contribution to which the creating and introduction of extinct species could make to our scientific knowledge.

As stated before, human impacts will continue doing a lot of damage before reaching its peak and start declining. Moreover, there is much criticism because of the current state of technology. Ecomodernism is, according to Arias-Maldonado (2018), guilty of “fabulism and its optimism about the future may appear not just self-delusional but outright dangerous” (p. 139). As technological advancements and their outcomes are hard to predict, accelerating modernisation could be a risky endeavour. Although ecomodernism seems more politically

viable, it is not necessarily more realistic than primitivism. Humanity would be taking enormous risks, and it will be hard to get everyone on board. This is further complicated because there is too little respect for cultural differences and current economic inequalities. Moreover, some authors warn against the risks of alienation of nature (Lomirer & Driessen, 2016).

Technological advancements can undoubtedly be beneficial, and as stated before, not many environmentalists would be entirely against further development of technologies such as renewable energy. Moreover, technological developments might be able to solve particular problems which are already created. But, by fully trusting on technology the way this is suggested by ecomodernism, we would most likely cause even more, (irreversible) damage in the process. “But their generalisations, their ignorance of history, their own unexplored prejudices and an astonishing lack of depth all contribute to a worldview that is, paradoxically, nothing if not old-fashioned” (Monbiot, 2015).

5.3 Sustainable society

A transition from our current society to one that is built on the premises put forward by both ecologism or eco-modernism pose some serious challenges. Karlsson presents three metaphors for sustainability in the Anthropocene, one of which is the “runway metaphor” (2016). With the runway metaphor, he aims to show how the risk of insufficient political commitment to either trajectory might lead to disaster. This is a valid concern and is relevant to consider for both a primitivist and ecomodernist society. Probably the most critical concerns are about political viability and the duration of the required transition. For ecomodernism, the transition period demands an increase of harmful activities leading to further environmental degradation and biodiversity loss. Although some effects of climate change might be able to be reversed by future technologies, as the development and the effects of these technologies are hard to predict, the accelerated road to a high-technology future, may also do more damage than we now anticipate. A shift to a more primitive society, on the other hand, will most likely be too slow and will require a serious decrease in population, before this type of society could prove to be eco-friendly than our current one. An environmentalist approach might be able to overcome these two obstacles because the society envisioned by this perspective is closer to our current society. Consequently, demanding fewer changes to our current social and economic structures, and maybe more importantly, the changes required progressively improve the situation during the transition, rather than add to the problem before solving it. This makes the environmental approach or a more ecological pragmatist approach a suitable one to accommodate rewilding,

potentially including de-extinction as conservation strategies.

Rewilding and de-extinction can be used to influence ecosystems and increase its biodiversity positively. This benefits these ecosystems and the animals living in them, and humans, both in economic or otherwise instrumental value, as well as providing recreational, aesthetic or scientific value. As argued in the previous section, some authors who criticise ecomodernism point at the danger of alienating ourselves from nature, especially if humanity would decouple itself from it, as ecomodernists propose. This problem does not occur within a society built on environmentalism, as some room is left for aesthetic and recreational value. Humans might get a new appreciation for nature if areas are restored by rewilding practices, especially with the reintroduction of charismatic megafauna. This argument is also frequently used in arguments in favour of de-extinction (see §3.6). Technologies used for de-extinction will most likely benefit our scientific and technological knowledge and will lead to advancements in these fields. These biotechnological developments not might not only help us to prevent future extinctions, but also to develop medicines, gain a better understanding of our own genetic makeup and may lead to other technological advances.

Sustainability is a well-known concept in environmental philosophy, as well as in nature conservation practices. More recently, the focus has been shifting from sustainability to resilience. Resilience was introduced as a term by Holling (1973), first in the context of ecosystems, as he developed this concept in the context of ecology. Before the emergence of this term, by focusing on sustainability, there was a too narrow focus on the presence or absence of particular species or populations (Doorn et al., 2019). This concern was too static and implied the assumption that there is only one state of an ecosystem in which it is stable. Crucial to this thinking is the understanding that the performance of a system is more than all the parts and components that make up the complete (eco)system (Doorn et al., 2019). Resilience should be understood as complementary to sustainability, not a substitute. Instead, this concept should add further nuance to the idea of sustainability, both to enrich it and to make it more suitable to the world around us.

Holling (1973) linked his insights on the importance of resilience to ecosystem management strategies. He claimed that a management approach that aims at stability, or sustainability, may not be sufficient in the case of complex ecosystems. Doorn et al. (2017) argue that aiming at stability might even lead to the loss of integrity in the system’s structure when an extreme situation occurs. They argue that instead of trying to control all changes that may occur, we should

focus on the ability to adapt to these changes. This argumentation can also be used to account for the search for the right historical baseline in the case of rewilding. Aiming to conserve a previously or currently existing ecosystem, can therefore be counter-productive.

Due to its focus on ecosystems as a whole and its resistance to change, resilience a well-fitting concept to rewilding, as well as the ecological pragmatist approach. One of the methods used in rewilding is the introduction of species that can re-establish certain interactions and restore the balance of the ecosystem, and this can promote self-regulating biodiverse systems. Norton (1986) focuses on the importance of ecosystems as a whole, while from a strong anthropocentric perspective, only species that provide a direct instrumental value, such as an economic one, should be made de-extinct. However, some less charismatic species, like plants or insects, can be vital for the balance of an ecosystem. By valuing these in the context of the ecosystem and as an essential factor contributing to the resilience of a system, we can justify saving or resurrecting seemingly less significant species as well, even within a (weak) anthropocentric approach.

Oksanen (2014) argues that often arguments made against increasing biodiversity with the use of de-extinction technologies refer to the method used. If technology is used to increase this biodiversity, it might be claimed that the wrongness of the act is related to the mode of technology because it results in unnaturalness. He notes that this is similar to the argument that a resurrected species is less valuable because it would have an unnatural origin. Not taking the intrinsic value of nature as a starting point, species would not necessarily be seen as less valuable if they indeed have an unnatural origin, as long as they provide another value, such as aesthetic or recreational values. This type of value will probably be considered even higher in the case of de-extinct species, compared to locally extinct and reintroduced species, as the “coolness factor” (Sherkrow and Greely, 2013), is undoubtedly higher.

5.3.1 Risks

Ecological pragmatism assumes that anthropocentrism and ecologism will lead to very similar practical outcomes. However, while anthropocentric motivations can lead to positive outcomes for both humans and the environment in cases they were both negatively affected, anthropocentrism always favours human interests. Anthropocentrism does not give priority to the protection of animal welfare and is less concerned with the loss of some biodiversity, as long as it does not directly affect human well-being (Crist, 2015). We should be aware that we may not know

the long-term consequences of the loss of biodiversity, and it is difficult to determine which and how many species should be saved. Washington (2013) argues that it remains unknown which keystone species would be necessary for our survival and states that this will probably remain the case. The statement that policies made based on anthropocentric interests would have the same practical outcomes in environmental protection as more ecocentric perspectives is not convincing, at least not in the long term. It is hard for humans to know now how much biodiversity is necessary for our survival and which species are most important. Ecosystems are complex, and their balance could be relevant to us in ways we are not even aware of yet.

While environmentalism offers practical and sensible reasons to use de-extinction as a conservation strategy, there are some risks involved that are important to consider. By taking a more ecological pragmatist, compared to a human instrumental position, there is more focus on the balance and complete ecosystems. Although an intrinsic value of non-human nature is not necessarily recognised within this approach, complete ecosystems are valued as a whole, rather than just charismatic megafauna. However, a widely felt concern relates to the difficulties of trying to predict scientific advances (Gamborg, 2014). Gamborg (2014) points out that there is a real danger that things may turn out to go horribly wrong when humans try to manipulate nature on the basis of “grand plans” for the future. Looking at examples of intentionally or unintentionally introduced animal or plant species, this seems like a valid concern. Sometimes when new species are introduced by humans, they bring about some kind of disaster. For instance, Gamborg (2014) states de-extinct animals could also turn into invasive species or a pest or may spread diseases. This is because there is a risk of homogenization, when newly created species displace native ones, which would also actually decrease the biodiversity (Oksanen, 2014).

When it comes to the protection of endangered species, they have their niches in functioning in the environment, while extinct species have lost theirs in the ecosystems. Hence, the reintroduction of extinct species, their revival raises the questions as to whether these organisms may increase competition for resources, or disrupt crucial ecological functions, in addition to raising concerns about unexpected effects due to use of modern biotechnology (Dana et al., 2012). Myhr and Myskja draw the analogy with the impacts made by invasive species. Most invasive species have not caused any problems and have been considered as an acceptable broadening of biodiversity. However, some species cause problems. Myhr and Myskja (2014) state that because ecosystems are complex, it is difficult to predict the effects of laboratory tested creations when released into the

environment. Gamborg (2014) warns against being blinded by technological optimism and focus too much on the potential benefits of these (bio)technological advancements. He states we should consider the negative consequences as well. Sarewitz (2004) argues that uncertainty about these impacts and effects should not be understood as lack of scientific knowledge, but also as lack of coherence in choices of models and underlying assumptions between different scientific disciplines.

An exemplary case of the disastrous effects non-native species can have on ecosystems is Australia. Although it is not the only country with invasive species, it is an isolated continent with unique wildlife, and top predators are long extinct, which gives non-native species a better chance to survive (Biba, 2017). Non-native animals have been introduced to Australia since the time of arrival of European settlers. Since then, Australians have been trying to control several invasive species with desperate measures, such as releasing viruses, spreading poisons or introducing non-native predator species. This has sometimes even created new problems, most notably the cane toad. Introduced in 1935 to prey on beetles that turned into a pest and became a threat to a commonly farmed crop, sugarcane, they turned into a pest species themselves, after found to be unable to climb sugarcane plants to reach the insects they were supposed to eat. As a highly poisonous animal without any natural predators, they are now a massive threat to native wildlife, killing unique Australian bird species. Other problematic non-native species in Australia are rabbits, feral cats, horses, European honey bees, goats and even camels, all posing serious treats by damaging vegetation, causing erosion, competing with native animals for food, or preying on them directly (Griffiths, 2017).

5.4 Precautionary principle

De-extinction is one of the biotechnological advances which are proposed as an addition to conservation strategies, such as rewilding. By saving endangered species and the de-extinction of lost species, the current loss of biodiversity could be tackled. However, as Myhr and Myskja (2014) argue, these possibilities also raise concerns regarding possible damage to the environment. They point to the complexity of natural systems, which imply that information considered in risk assessments may be insufficient for making decisions entirely based on scientific evidence. Nielsen and Myhr (2007) state that these types of interventions in complex biological systems inevitably lead to certain risks. To understand the uncertainties arising from technological advancements, Nielsen and Myhr (2007) look into the case of Genetically Modified Organisms (GMOs). They divide the type of uncertainties into three categories: “i. Reducible uncertainty, due to lack of

knowledge and the novelty of the activity that can be addressed with more research and focused collection of empirical data. ii. Irreducible uncertainty, due to inherent randomness, variability and complexity in the biological system under consideration. iii. Uncertainty arising from ignorance given that the prevailing operating paradigms and models do not adequately represent the biological system evaluated" (Nielsen & Myhr, 2007, p. 2).

To deal with this uncertainty central to debates concerning bio- and nanotechnology, Myhr and Myskja (2014) state that the precautionary principle has been a controversial strategy. According to O'Riordan and Jordan (1995), the precautionary principle remains a concept that varies in definition and application. They claim that the strength of this concept is that it: "provides an intuitively simple guide to humans on how to intervene in environmental systems in a manner that is less damaging" (O'Riordan & Jordan, 1995, 191). Therefore, this might be a helpful concept in political decision making concerning de-extinction and the use of other biotechnology for conservation purposes. Although the term has been widely accepted, even used by the United Nations and the European Union, it does not provide many operable guidelines for policy-makers (O'Riordan & Jordan, 1995). These authors warn against the risks of this principle becoming increasingly integrated into modern environmentalism and draw a parallel with the concept of sustainability was incorporated. They point out the similarities as the success of sustainability was also characterised by the various meanings, often even contradictory and impractical, that was given to this notion. Despite these issues, the precautionary principle has potential, because "it captures an underlying misgiving over the growing technicalities of environmental management at the expense of ethics, environmental rights in the face of vulnerability, and the facilitative manipulation of cost-benefit analysis" (O'Riordan & Jordan, 1995, p. 192). The concept challenges weak points of the application of cost-benefit analysis, namely situations in which environmental damage could turn out to be catastrophic or irreversible.

O'Riordan and Jordan start exploring the concept by formulating its core., building on the idea that "it is better to be roughly right in due time, bearing in mind the consequences of being very wrong, than to be precisely right too late" (O'Riordan & Jordan, 1995, 194). Firstly, they state it requires modifications in the principles and procedures of law such as "liability, compensation and burden of proof" (O'Riordan & Jordan, 1995, p. 193). They are calling on decision-makers to act ahead of absolute scientific certainty in order to protect the environment, keeping in mind the interests of future generations. However, as the precautionary principle is usually used to protect the environment against potentially harmful

(technological) changes, it is even more challenging to apply this concept to bio-technologies that are targeted to actually restore environmental damage, besides there being already different interpretations. This problem is visible when taking a closer look at some of the core elements as put forward by O'Riordan and Jordan (1995). For example, they argue that both "willingness to take action in advance of scientific proof" and "safeguarding ecological space" (p. 195) are core elements of the precautionary principle. When applying these elements to the idea of de-extinction, the first seems to inform us to pursue these new technologies, while the latter questions how far natural systems are resilient to changes and may lead us to act with more caution. Although this is just one example of the different possible interpretations of the precautionary principle, it shows the concept is often defined and applied in various ways. To get a better understanding of how to apply this principle in a useful, we turn to authors who have tried to interpret the precautionary principle in the context of de-extinction, or other biotechnologies.

Myhr and Myskja (2014) investigate the way the precautionary principle was applied in the context of Genetically Modified Organisms in Europe to see how it can be operationalised and used in the de-extinction debate. They state that the implementation of the principle entails two elements that are interrelated, firstly, caution should be taken with the application of new technologies and secondly, the importance of conducting research which is risk-associated is emphasised. They summarise the principle as follows: "When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm" (Myhr & Myskja, 2014, pp. 127-128). In their 2011 article, Myhr and Myskja question if shifting the burden of proof is always desirable or justified, even if the principle would provide a good tool to do this. Moreover, they state it remains vague what the responsibility of "taking precaution" means in practice, as in most literature, it does not seem to call for a ban of the proposed activities.

Keeping in mind the ecological complexity that will be intervened in with technologies like de-extinction, Myhr and Myskja (2014) also question whether taking this principle as a guideline is adequate. Rather than interpreting the precautionary principle as "avoidance of harm", they propose a focus on an "ethics of responsibility approach" instead. This approach was suggested by Jonas (1979) and is compatible with the precautionary principle while offering a broader scope. An implicit part of this imperative of responsibility is that there is a duty to acquire adequate knowledge in order to contribute to the good of future generations, which implies the acceptance of uncertainty, while at the same time

encouraging innovation. Myhr and Myskja (2014) therefore argue that there is a need for a combined scientific and ethical analysis, which should involve the concept of responsibility to provide a sufficient basis for decision-making. O'Riordan and Jordan (1995) argue for a set of clearly defined principles, which could provide some guidance in political decision making. As such a definition is currently lacking, it is hard to apply the precautionary principle to the case of de-extinction in a useful way.

Chapter 6: Conclusion

This thesis has explored the concept of de-extinction by first considering both the technical and ontological possibilities of reviving a species. While projects using back-breeding, cloning and genetic engineering, or a combination of these techniques, still run into serious problems and will most likely remain very costly

in the near future, advances in biotechnology are made quickly and are generally hard to predict. If researchers succeed in the recreation of an extinct species, this will change the way we can, and probably will, intervene in the non-human world. Currently, it seems like we will only be able to create, more or less exact, copies of extinct animals, by recreating its phenotype or genotype. However, because the relationship with their natural environment is lost and a surrogate species would raise the resulting animals, the created animal would arguably not be considered as a new member of the extinct species. In terms of aesthetic values and benefits to science and conservation, this is not necessarily problematic. The selection of candidate species to resurrect depends partly on the technical possibilities, which, for now, mostly restrict us to animals that have just recently become extinct, because there is a higher chance we can find intact DNA. Which species would be ideal to de-extinct once we have greater practical possibilities, may be more dependent on the goals of these projects.

Environmental ethics can recognize the increased aesthetic value, as de-extinct animals can enhance our appreciation of nature, which can boost the recreational value of an ecosystem, and even lead to an increased public awareness of the importance of conservation. In more direct instrumental terms, it can help the development of tourism and the development of local economies. De-extinction projects can also increase our scientific knowledge, a benefit which may be valued on its own, but could also contribute to the protection of endangered species, for example, by adapting species to become more resistant to the effects of global warming.

Maybe the most apparent benefit that de-extinction projects may have, is related to the effect of the species on ecosystems, once they are (re)introduced. As a potentially useful addition to conservation strategies such as rewilding, recreated species might be beneficial to ecosystems in which they fulfilled an ecological niche. Species such as the woolly mammoth might even help to create novel ecosystems, like an artic steppe. More indirectly, they also contribute to the overall biodiversity and may increase public support for such projects. However, aiming to (re)introduce de-extinct species comes with enormous risks as well. These animals could become transmitters of diseases because of their vulnerability, have a high risk of becoming invasive and cause a problematic imbalance in an existing ecosystem. We do currently not know enough about the complexity of ecosystems to successfully avoid the risks that the de-extinct species may pose. Furthermore, challenges usually arising within reintroduction projects as part of more “conventional” rewilding, such as possible tensions with local communities, will have to be overcome as well.

With the current loss of species and the rapid decline of biodiversity, there is an urgent necessity to make grand-scale political decisions, deciding on the way we might want to intervene in nature. As our current way of living causes a significant loss of species, it is crucial to investigate possible alternatives. In this thesis, alternative societies based on three distinctive perspectives within environmental philosophy are proposed, and the possibilities and risks of transitioning to these societies, as well as incorporating de-extinction within them, are elaborated upon. These alternatives included societies based on ecologism, ecomodernism and environmentalism, including a more ecological pragmatist approach. A transition to a primitive society requires a significant decrease in the human population, in order for it to become beneficial to non-human nature compared to our current society, and its political viability is questioned, even by some of its proponents. Within a primitive society, there is little room for intervention in nature and de-extinction projects in particular, as this is considered to be in contradiction with the goals of humans' "harmonisation with nature". Both humans and non-human nature need to rewild, going back to our "first nature" and leaving mediations such as technology behind.

Transitioning to a society envisioned by ecomodernists causes its own problems. As we need to accelerate the current economic and technological developments, we might do much additional damage in the process. Technological advancements are hard to predict, so we need to fully trust the possibility to restore the ecological damage and decrease in biodiversity if we would commit to this approach. While the runway metaphor aims to show how insufficient political commitment to either one of the proposed trajectories can be disastrous, an alternative to 'radical' approaches may be more politically and ethically viable: ecological pragmatism.

Ecological pragmatism argues that anthropocentric and non-anthropocentric philosophical theories make little to no difference in the practical policy outcomes. Without having to resort to holistic arguments, or needing to prove the direct instrumental value to humans of each species, it may offer a perspective that includes the long-term advantages of the protection of natural systems and all the living organisms in it. Taking a weak anthropocentric and more pragmatic approach, one does not necessarily take an active, principled philosophical stance, but rather develops arguments necessary for political decision-making, while leaving room for individual's underlying values and motivations (Norton, 1964). This undeniable practical advantage can certainly prove essential in the near future. While reducing the debate between ecologism and environmentalism to a petty fight, would not do justice to the rich philosophical arguments made by

both perspectives, it does help to develop concrete policy measures, which can and should be, implemented in the short term. By taking this pragmatist approach, we can adequately judge the benefits and risks posed by the possibility of ecosystems.

Allowing ourselves to be inspired by the technological optimism of ecomodernism, we can recognize that (bio)technological developments and other technological advancements can be beneficial for conservation strategies, including rewilding. These possibilities may turn out to be vital to saving species in the future, maintain or restore biodiversity and balance in ecosystems, by bringing back species that had a unique role in their ecosystems. However, possible harm to the ecosystem, as well as impacts of the moral hazard problem should be considered.

Humans often know too little about the complexity of ecosystems to successfully intervene. Ecosystems are complicated , with many interdependent elements. It may be close to impossible to predict what will happen if species are released into the wild, as our current predictions are based on results from laboratory or controlled field studies. We caused species to become invasive in the past, even when they were introduced explicitly as part of conservation efforts. The precautionary principle proves to be of little help in judging these cases, as it is generally poorly defined and offers little practical guidelines which can be applied to the development of biotechnologies with the aim of improving ecosystem health.

De-extinction will not make sense as a conservation strategy if we do not make changes to avoid further extinctions if humanity keeps destroying ecosystems and does not remove the original causes of extinction. As a conservation strategy, it is also not the most (cost) effective approach, and it seems highly unlikely that it will become one shortly. Furthermore, as the risks for further damage to ecosystems are significant, developing de-extinction technology might not seem to be worthwhile. However, considering the aesthetic and technological benefits, we should not exclude any development of these technologies. Technological advancements are hard to predict, and these projects might prove beneficial in ways we are not aware of now. Lastly, if we have no other options, or all other attempts to maintain or restore biodiversity, knowledge of these techniques and stored DNA samples, might be a good last resort to have.

In conclusion, while the possible ecological benefits do not currently outweigh the potential risks, this thesis does not exclude the option of further developing de-extinction technology for other reasons. (Bio)technological advancements and

aesthetic arguments might be sufficient to justify these projects because of their instrumental value to humans, but also because of their more indirect positive influence on conservation goals.

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