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Analysis

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De-Extinction, Regulation and Nature Conservation

Jessica Allen*, David M. Doyle**, Shane McCorristine*** and Aisling McMahon****

ABSTRACT

This analysis maps the key challenges posed by de-extinction to nature conservation law. The aim is to start a conversation about how such challenges should be framed and addressed if ongoing de-extinction projects in the United States of America (US) and the European Union (EU), the two jurisdictions examined, are successful. The analysis commences by providing a brief overview of existing debates in the conservation literature on the legal and ethical issues posed by de-extinction within the animal context. The article then proceeds to highlight two challenges animals created via de-extinction (de-extinctees) will likely pose for nature conservation law, namely: (1) to what extent taxonomies or definitions of 'species', and the methods for classifying these species under existing conservation frameworks, will be challenged by de-extinction; and (2) how existing conservation law frameworks in the US and the EU would likely apply to de-extinctees, and whether de-extinctees would be protected under these frameworks. It concludes by posing the broader question of whether and to what extent the law should facilitate de-extinction attempts in the same way that it has done for nature conservation.

KEYWORDS: De-extinction, nature conservation, cloning, back-breeding, genetic engineering, Europe, United States

1. INTRODUCTION

The history of life on Earth is arguably a history of extinction on different scales, featuring the relentless disappearance and appearance of species.[1] Yet conservationists argue that the current sixth mass extinction is different given the speed of change, the anthropogenic causes of biodiversity collapse and the consequences for human

* Jessica Allen, Research Assistant, Faculty of Law, University of Oxford (jessica.allen@law.ox.ac.uk).
** David M. Doyle, Assistant Professor/Lecturer in Law, Maynooth University (david.doyle@mu.ie).
*** Shane McCorristine, Lecturer in Modern British History, Newcastle University (shane.mccorristine@ncl.ac.uk).
**** Aisling McMahon, Assistant Professor/Lecturer in Law, Maynooth University (aisling.mcmahon@mu.ie).

1 See Edward O Wilson, *The Diversity of Life: With a New Preface (Questions of Science)* (Harvard University Press 2010).

life.[2] Moreover, the implication of the current extinction phase for countless biodiverse species is drastic: annihilation. Attempts to halt extinction, protect endangered species and maintain their habitats through legal frameworks have thus dominated wider conservation attempts.

Alongside conservation efforts, de-extinction has emerged as a focus of scientific research, which in turn has ignited intense debates among natural and social scientists in the past decade.[3] De-extinction refers to plans to bring back, or 'resurrect', certain extinct species through three main avenues.[4] First, 'cloning' only works if sufficient quantities and a high quality of DNA from the extinct species are available and—if successful—produces a genetic replica of the extinct species. Secondly, 'back-breeding' involves breeding similar animals over several generations to try and create an animal which is similar to an extinct species (eg aurochs, an ancestor of cattle). Thirdly, 'genetic engineering' is the process whereby embryos of animals similar to an extinct species are edited and implanted into similar sized animals in an attempt to create a hybrid animal which looks like the extinct species (eg using elephants to recreate an animal similar to the woolly mammoth).[5]

Each of these techniques has caught the public imagination:[6] what if scientists can revive and restore the woolly mammoth—which became extinct circa 4000 years ago—to the tundra ecosystem of Siberia? Or bring back the Thylacine (the 'Tasmanian tiger') to Tasmania, where humans drove it to extinction in the 1930s? De-extinction projects of this type generate popular interest because they seem to offer a scientific solution to extinction and species loss.[7] They also raise serious legal questions,[8] including inquiries relating to nature conservation law, which is the focus of this analysis.

2 See Richard McLellan and others (eds), *Living Planet Report 2014: Species and Spaces, People and Places* (WWF 2014); Paul J Crutzen and Eugene F Stoermer, 'The "Anthropocene"' (2000) 41 Global Change Newsletter 17; Elizabeth Kolbert, *The Sixth Extinction: An Unnatural History* (Bloomsbury 2015).

3 Ronald Sandler, 'The Ethics of Reviving Long Extinct Species' (2014) 28 Conservation Biology 354; Shlomo Cohen, 'The Ethics of De-extinction' (2014) 8 NanoEthics 165; Paul R Ehrlich and Anne H Ehrich, 'The Case Against De-Extinction: It's a Fascinating but Dumb Idea' (*Yale Environment 360*, 13 January 2014) <https://e360.yale.edu/features/the_case_against_de-extinction_its_a_fascinating_but_dumb_idea> accessed 7 May 2019; Ben A Minteer, 'The Perils of De-extinction' (2015) 8 Minding Nature 11; David E Blockstein, 'We Can't Bring Back the Passenger Pigeon: The Ethics of Deception around De-extinction' (2017) 20 Ethics, Policy & Environment 33; TJ Kasperbauer, 'Should We Bring Back the Passenger Pigeon? The Ethics of De-extinction' (2017) 20 Ethics, Policy & Environment 1; and Patrice Kohl, 'Using De-extinction to Create Extinct Species Proxies; Natural History not Included' (2017) 20 Ethics, Policy & Environment 15.

4 William M Adams, 'Geographies of Conservation 1: De-extinction and Precision Conservation' (2017) 41 Progress in Human Geography 534.

5 Beth Shapiro, *How to Clone a Mammoth: the Science of De-extinction* (Princeton University Press 2015).

6 Carl Zimmer, 'Bringing them Back to Life' (2013) 223 National Geographic 28.

7 For a summary, see Ben Jacob Novak, 'De-Extinction' (2018) 9 Genes 548.

8 Broader legal questions include: Who would own these revived species? How would their habitat be governed? Would their creators face tort liability for any resulting harm to the ecology, domestic animals or humans? In short, whether created for existence in laboratories, captivity or in the wild, de-extinction science raises a number of legal issues that must be explored before de-extinction becomes common practice. Dan Farber, 'De-Extinction Conference' (*Legal Planet*, 22 June 2013) <http://legal-planet.org/2013/06/22/de-extinction-conference/> accessed 5 May 2017.

The structure of this analysis proceeds as follows. Section 1 outlines the framework of analysis by providing a brief overview of existing debates in conservation-specific literature on the legal and ethical issues posed by de-extinction. Section 2 probes the challenges that de-extinctees are likely to pose to the taxonomies or definitions of species, and to existing frameworks for conserving endangered animals/habitats at a conceptual level. Section 3 examines, from a practical perspective, how existing nature conservation laws in the United States of America (US) and the European Union (EU) would apply to de-extinctees. It highlights the challenges that de-extinction is likely to pose to such legal frameworks, and the gaps which may need to be filled should de-extinction projects prove successful. Finally, Section 4 concludes by posing the broader question of whether and to what extent the law should facilitate de-extinction attempts in the same way that it has done for nature conservation.

Importantly, it must be stressed that the questions and challenges explored in this analysis are not hypothetical. Major de-extinction projects are currently ongoing in North America and Europe.[9] Scientists in both continents have made significant progress with de-extinction attempts via cloning,[10] although the revival of extinct species has not yet been achieved.[11] In 2003, a cloned individual of the extinct Pyrenean ibex was successfully born, although it died shortly afterwards.[12] Meanwhile, scientists in the 'Tauros Programme' are using back-breeding to restore a breed of auroch to parts of Europe.[13] Furthermore, using genetic engineering techniques, the team leading the de-extinction project to bring back the woolly mammoth estimates that it is close to creating a hybrid mammoth–elephant embryo.[14] In short, de-extinction is likely in the not too distant future.[15]

Following from this, and as a caveat, this analysis does not seek to take a normative position on the type of legal protection (if any) which should apply to de-extinctees. Given the infancy of such techniques, and the difficulties in foreseeing their effects and likely consequences on wider ecosystems, much still remains unknown. This analysis aims to set out the key questions to which conservationists and environmental lawyers will be confronted in this context, and to provoke a conversation on how we should approach such issues. In doing so, the analysis will focus on

9 AG Clarke, 'The Frozen Ark Project: the Role of Zoos and Aquariums in Preserving the Genetic Material of Threatened Animals' (2009) 43 The International Zoo Yearbook 222; Helena Siipi and Leonard Finkelman, 'The Extinction and De-Extinction of Species' (2017) 30 Philosophy of Technology 427; Paul Jepson, 'A Rewilding Agenda for Europe: Creating a Network of Experimental Reserves' (2016) 39 Ecography 117.

10 Miguel García-Sancho, 'Animal Breeding in the Age of Biotechnology: The Investigative Pathway behind the Cloning of Dolly the Sheep' (2015) 37 History and Philosophy of the Life Sciences 282.

11 Hannah Devlin, 'Woolly Mammoth on the Verge of Resurrection, Scientists Reveal' *The Guardian* (London, 17 February 2017).

12 Jose Folch and others, 'First Birth of an Animal of an Extinct Subspecies (Capra pyrenaica pyrenaica) by Cloning' (2009) 71 Theriogenology 1026. As cited by Jacob S Sherkow and Henry T Greely, 'What if Extinction is not Forever?' (2013) 340 Science 32.

13 Sherkow and Greely, ibid, 32.

14 Devlin (n 11).

15 Josh Donlan, 'De-extinction in a Crisis Discipline' (2014) 6 Frontiers of Biogeography 25, 28; Devlin (n 11); Kevin O'Sullivan, 'The Mammoths' Return: Scientist Predicts 'De-extinction' of Long-lost Animals' *Irish Times* (Dublin, 5 September 2018).

US and EU law for two principal reasons. First, these jurisdictions have two of the most well-established nature conservation regimes worldwide.[16] Secondly, they are likely to be the first to countenance the novel problem of protecting de-extinctees, due to de-extinction projects already underway within their borders.

2. DE-EXTINCTION AND TENSIONS WITH NATURE CONSERVATION

In the past few decades, dozens of scientific projects have explored the possibility of resurrecting extinct species—such as the Heath hen, the Passenger pigeon and the Pyrenean ibex—through back-breeding, cloning and genetic engineering projects. Related scientific techniques are also being earmarked for species that are currently critically endangered and close to extinction, such as the Pink pigeon and the Florida panther.[17] However, the ontological status of both endangered species and extinct species is unclear: can we really know when the last member of a species has died, thus moving it between such categories?[18] Furthermore, the notion of extinction being the end point for a species may become unstable if de-extinction attempts prove successful. As a consequence, the traditional aim of conservation organisations—to conserve biodiversity[19]—becomes complicated by the dynamic interaction of multiple cultural–ecological processes that push and pull species towards absence and presence (see Figure 1).

Hovering between life, death and potential rebirth, many species of animals exist today on the brink between extinction (absence) and/or resurrection (presence). In ecological and scientific terms, many species are formally on the brink of disappearance (eg the International Union for the Conservation of Nature's (IUCN's) Red List), while a smaller number are formally on the brink of reappearance (eg the 20 or so animals earmarked for de-extinction by genetic engineers in the near-future). Put otherwise, de-extinction will likely pose questions for how we conceive 'endangerment', which in turn could challenge existing conceptions of how biodiversity is or should be 'conserved'. However, much is likely to depend on the scientific processes used to facilitate de-extinction. For instance, it is only de-extinctees created via cloning that are genetically similar to the existing animal.[20] Consequently, some question whether a de-extinctee would resemble its ancestors, or even represent the return of a 'species' at all, given its environmental and epidemiological differences with the extinct animal, its synthetic birthing and the lack of any existing habitat.[21]

Furthermore, in the context of mass extinction, the motives for reintroducing a species are countless: restoring species biodiversity and variability; rejuvenating declining ecosystems via the (re)introduction of environmental engineers;

16 See William M Adams, *Against Extinction: The Story of Conservation* (Routledge 2004); William M Adams, *Green Development: Environment and Sustainability in a Developing World* (3rd edn, Routledge 2008).

17 See Laura Poppick, 'Threatened Species? Science to the Genetic Rescue!' (*Smithsonian*, 27 April 2017) <https://www.smithsonianmag.com/science-nature/threatened-species-science-genetic-rescue-180963040/> accessed 27 September 2019.

18 Shane McCorristine and Bill Adams, 'Ghost Species: Spectral Geographies of Biodiversity Conservation' (2020) 27 Cultural Geographies 101.

19 Adams (n 16).

20 See above Section 1.

21 Blockstein (n 3).

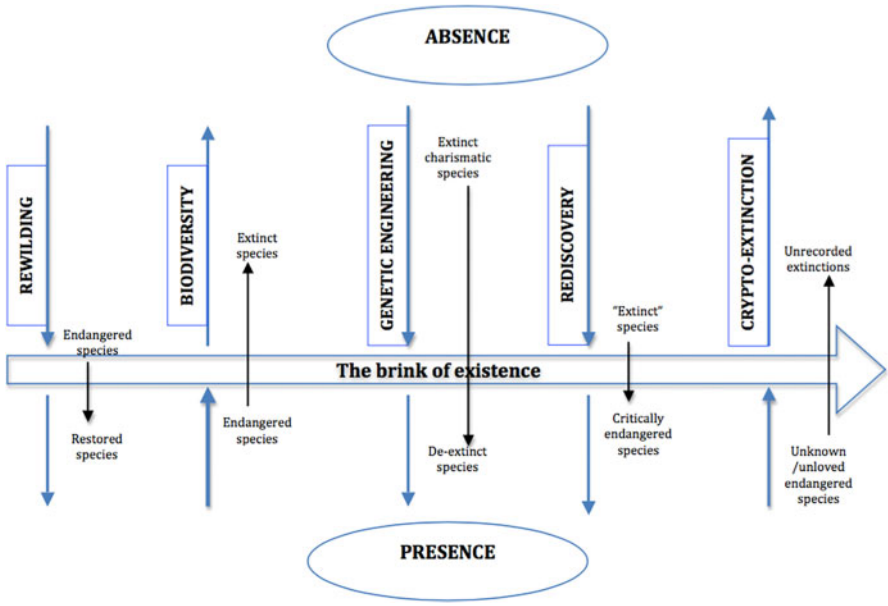

Figure 1. Flow chart showing cultural–ecological processes pushing and pulling species over the brink.

replenishing a depleted food source or creating a new one; or even regenerating commercial revenue via the resurrection of animals. For example, the motivation of some de-extinction projects could be commercial gain, by seeking to reap the financial benefits of creating an extinct animal well-known within popular culture (eg the woolly mammoth) and making the animal a spectacle.[22] Political motivations may also be a factor. Remarkably, plans to clone mammoths and establish a 'Pleistocene Park' in Russia have received attention from politicians, including President Vladimir Putin.[23] From this perspective, the de-extinction space may be guided by multiple and varied agendas. Might state-funded science programmes be used to exert geopolitical power, as is the case with China's use of pandas in their diplomatic relations with western nations?[24] Might private sector for-profit genetic editing companies ignore public-good science arguments and misuse scientific breakthroughs in the interests of shareholders? These uncertainties raise further questions as to whether legal protection, such as that which applies to endangered species in a conservation context, should apply also to de-extinctees.

22 Adams (n 4); Patrick M Whittle, Emma J Stewart and David Fisher, 'Re-creation Tourism: De-extinction and its Implications for Nature-based Recreation' (2015) 18 Current Issues in Tourism 908; Norman F Carlin, Ilan Wurman and Tamara Zakim, 'How to Permit Your Mammoth: Some Legal Implications of De-extinction' (2013) 33 Stanford Environmental Law Journal 3.

23 See Henrietta Mondry, 'Selecting Candidates for De-extinction and Resurrection: Mammoths, Lenin's Tomb and Neo-Eurasianism' (2017) 6 Animal Studies Journal 12; 'Putin Shows Interest in Cloning Woolly Mammoths' *The Moscow Times* (Moscow, 1 September 2014).

24 Jamil Anderlini, 'How the Panda Became China's Diplomatic Weapon of Choice' *Financial Times* (Hong Kong, 2 November 2017).

Moreover, de-extinction, if successful, would require decisions to be reached on whether and which species should be selected for de-extinction projects, as well as the grounds for those decisions. It also raises questions about funding: should governments have a duty to engage in de-extinction attempts, akin to duties to conserve endangered species (eg the Endangered Species Act (ESA) 1973)? And if so, how should finances be allocated between conservation and de-extinction projects?

In short, the very notion of de-extinction presents a range of ethical, economic and practical questions which complicate potential benefits for existing conservation attempts. As our Figure 1 demonstrates, the de-extinction of charismatic species is just one among a multitude of strategies that are being deployed to save or retrieve species. The tension between 'conserving' and 'recreating' illustrated in this spectrum is likely to increase should de-extinction attempts prove successful. Any resolution will likely prove difficult, especially as some conservationists worry that funding will be redirected away from biodiversity efforts to save known species towards de-extinction projects concerning long-extinct mammals only.[25] In circumstances where the loudest non-governmental organisations (NGOs) and most charismatic species stand the best chances of attracting attention, 'crypto', 'silent' or unrecorded extinctions will undoubtedly continue, especially of fungi and insect biomass that traditionally lack charisma for humans.[26]

3. DE-EXTINCTION AND QUESTIONS FOR CLASSIFICATION OF ANIMALS

If de-extinction projects prove successful, they will give rise to conceptual questions for existing species classification, and the taxonomies upon which existing systems of legal protections for endangered species are built. This will, in turn, give rise to questions as to whether and how de-extinctees ought to be protected under existing conservation laws.

The establishment of any regulatory regime involves identifying what should be regulated and how regulation should be approached.[27] As regards nature conservation, although some regimes specify which species are to be legally protected, many regimes set out the underlying principles for protection and create a listing process by which a species can be identified and classified as 'in need of protection'.[28] The latter approach to offering legal protection to endangered species is common due to the sheer number of endangered species in need of protection, currently estimated at

25 Novak (n 7).

26 See Nico Eisenhauer, Aletta Bonn and Carlos A Guerra, 'Recognising the Quiet Extinction of Invertebrates' (2019) 10 (50) Nature Communications <doi.org/10.1038/s41467-018-07916-1> accessed 27 April 2019.

27 Liz Fisher, Bettina Lange and Eloise Scotford, *Environmental Law Text, Cases, and Materials* (OUP 2013) 486.

28 See eg the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (signed 3 March 1973, entered into force 1 July 1975), arts I–II; Council Directive (EEC) 92/43 of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206 (Habitats Directive), arts 1–5; European Parliament and Council Directive (EU) 2009/147/EC of 30 November 2009 on the conservation of Wild Birds (Birds Directive), arts 1–4; Endangered Species Act (ESA) 1973, ss 2–4.

over 27,000 according to the IUCN Red List.[29] However, this approach is already complicated by the difficulties in defining what a 'species' is; in determining the extent to which different populations are distinct species; and in identifying what legal status a species does, or should, have. Recognising this uncertainty goes some way to explaining the complexity of the listing procedures that are contained in these conservation regimes. Indeed, the procedure set out in the Convention on International Trade in Endangered Species (CITES) of Wild Flora and Fauna, on which many other regimes are modelled, lists species at a number of taxonomical scales, including orders, sub-orders and individual species. The potential arrival of de-extinct animals will create deeper uncertainties in existing methods for classifying species by challenging the taxonomical and protective principles on which they depend.

Indeed, Wagner and others have argued that the nature of the scientific process used to reintroduce a species will likely affect its nomenclature and taxonomy.[30] Whereas cloning could produce an animal that is genetically and taxonomically similar to one that previously existed, facsimiles created via back-breeding or genetic engineering would probably obtain distinct zoological names, particularly if they form reproducing populations.[31] For instance, a de-extinct woolly mammoth created via genetic engineering of an elephant embryo with mammoth DNA may be more appropriately described as a 'mammophant' or an 'elemoth' as it consists of a combination of engineered elephant and mammoth DNA.[32]

Furthermore, issues also arise in terms of what legal protections (if any) should be granted to de-extinctees. For example, de-extinctees which are genetically identical clones of newly extinct animals may be subject to the laws (if any) that previously applied to its extinct counterpart. However, the same cannot be said of de-extinctees, also produced via cloning, which are genetically identical to species that went extinct prior to the establishment of national and international conservation regimes. If legal protections did exist—as in the case of some birds and mammals before the era of conservation—they were designed to ensure the protection of game species for future hunting seasons. Similarly, de-extinctees produced via back-breeding and genetic engineering will not *per se* have been protected previously as they are effectively hybrid animals. Nonetheless, uncertainty exists as to how these de-extinctees would be protected, as some existing regimes already provide for the inclusion of hybrid species with the listed surrogate species, whereas other regimes are silent.[33]

It is also unclear how the legal protection of these animals, or the wider regulation of de-extinction, should be approached in such contexts. Should the fact that such animals are recreated to bear resemblance to extinct species have any relevance, from a legal perspective, to their status of protection? Moreover, the application of legal

29 IUCN Red List Version 2019-1: Table 1a (21 March 2019) <https://www.iucnredlist.org/resources/summary-statistics#Summary%20Tables> accessed 27 April 2019.

30 Norman Wagner and others, 'De-extinction, Nomenclature, and the Law' (2017) 356 Science 1016.

31 International Commission on Zoological Nomenclature, *International Code of Zoological Nomenclature* (entered into force 1 January 2000), art 17.2.

32 Helen Pilcher, 'Reviving Woolly Mammoths Will Take More Than Two Years' (*BBC*, 22 February 2017) <http://www.bbc.com/earth/story/20170221-reviving-woolly-mammoths-will-take-more-than-two-years> accessed 24 September 2019.

33 Oliver Frey, 'When Science and the Statute Don't Provide an Answer: Hybrid Species and the ESA' (2015) 26 Duke Environmental Law & Policy Forum 181, 186.

protections to de-extinctees could be in tension with the protection of existing endangered species and their habitats, as rewilding a de-extinctee could place other species in the ecosystem at risk. It is not clear how legal systems of species protection would prioritise between species, should any such protections apply to de-extinctees. As a result, the attributable standard of legal protection will be either uncertain or non-existent.

Any attempt to bridge the lacunae in existing regimes in order to accommodate de-extinctees may also be undermined by the legal dualisms that are intrinsic to them.[34] In particular, it is conceivable that any criteria relating to the 'positive' aspect of these dualisms—such as 'naturalness', 'endangerment' and 'nativeness', which go in favour of attracting legal protection—would probably result in legal protection being denied to de-extinctees, as they do not share such features.[35] For example, cloned animals would be neither natural nor native in the sense that the extinct animal would have already vanished from the landscape, as illustrated in relation to the US and EU regimes in Section 4.2. This reinforces the contention that the taxonomy and legal definition of de-extinctees in species protection regimes will require careful consideration.

4. DE-EXTINCTION AND NATURE CONSERVATION IN THE US AND THE EU

Having illuminated the main conceptual challenges posed in relation to the legal status of de-extinctees under nature conservation law, this section explores these issues further by examining how de-extinctees may be treated within the current conservation regimes of the US and the EU.

4.1 Existing Legal Protection

In cases where a de-extinctee is genetically and taxonomically identical to an extinct animal, such as a cloned animal which derives its DNA wholly from an extinct counterpart, its legal status would arguably be the same as the legal status accorded to the extinct animal. Yet a cursory survey of the US and EU conservation regimes reveals little about how the legal status of a newly extinct species is determined. As indicated above, each of these regimes rely on a listing procedure to decide whether and to what extent a species will benefit from legal protection.[36] However, in neither the US nor EU systems are the detailed provisions on the listing of species supplemented by any provisions on the potential de-extinction of a species.

4.1.1. Existing legal protection in the US

In the US, the ESA 1973 affords protection to any species that is classified as 'endangered' or 'threatened'.[37] 'Endangered' indicates that a species is in danger of

34 Camacho offers an insightful critique of the law's reliance on established and emerging legal dichotomies, which poses particular problems for de-extinct species in the context of nature conservation in the US. See Alejandro E Camacho, 'Going the Way of the Dodo: De-Extinction, Dualisms, and Reframing Conservation' (2015) 92 Washington University Law Review 849.

35 ibid.

36 ESA 1973, s 4(c) (n 28); Habitats Directive (n 28), art 4.

37 John A Vucetich, Michael P Nelson and Michael K Phillips, 'The Normative Dimension and Legal Meaning of Endangered and Recovery in the U.S. Endangered Species Act' (2006) 20 (5) Conservation

extinction throughout all or a significant portion of its range,[38] whereas 'threatened' indicates that a species is likely to become an endangered species within the foreseeable future.[39] Whether a species is endangered or threatened will depend on its extinction risk, the determinants of which are identified as: damage to or destruction of habitat; over-utilisation for commercial, recreational, scientific or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms; or other natural or man-made factors.[40] A species may also be 'endangered or threatened due to similarity of appearance' with another endangered or threatened species.[41] An endangered or threatened species may alternatively be categorised as a 'candidate',[42] pending a listing decision, or an 'experimental essential or non-essential population',[43] pending its introduction into an unoccupied portion of its former range or outside of its former range. Species that do not satisfy any of these criteria are not eligible for listing under the ESA 1973.

If a species is already extinct and is being re-created, it is questionable how it would be treated under such categories, but arguably it would not qualify for any legal protection. For example, the extinction risk of a cloned animal based on the determinants outlined above is not clear. If that animal is treated as akin to a representative of the previously existing species, then given the likely small number of cloned animals existing, one might consider that it may benefit from protection on the grounds that it is the identical genetic copy of an extinct animal and, if only in existence in small numbers, that it is threatened or in danger of extinction. However, the conditions of eligibility for classification as endangered or threatened suggests otherwise. If extinct, then the animal will have no habitat *per se*, making it questionable how one could define damage or destruction of their habitat. The other categories of risks, such as use for commercial or recreational purposes, are also unlikely to apply to de-extinctees. Having said this, it is unclear how the adequacy of regulatory mechanisms might be assessed in such contexts, and this may be open to challenge if, or when, de-extinction involving cloning is successful.

Further, it is foreseeable that legal protection for endangered or threatened species will be formally lost once a species is no longer endangered and has become actually extinct. Species can be listed through the candidate assessment programme of the Fish and Wildlife Service upon its own initiative or by individual petition.[44] Any decision to list a species must be made on the basis of the best available scientific and commercial data.[45] While there is no provision that explicitly authorises and regulates a delisting decision, the ESA 1973 implicitly recognises that the legal status of a species can change because a status review is required before any decision is

Biology 1383; Martha Williams, 'Lessons from the Wolf Wars: Recovery v. Delisting Under the Endangered Species Act' (2015) 27 Fordham Environmental Law Review 106.

38 ESA 1973, s 3(6) (n 28).

39 ibid, s 3(20).

40 ibid, s 4(a)(1).

41 ibid, s 4(e).

42 ibid, s 4(b)(3).

43 ibid, s 10(j).

44 ibid, s 4(c)(1)–(2).

45 ibid, s 4(b).

made.[46] Accordingly, the Fish and Wildlife Service has become increasingly proactive in reclassifying or delisting species that no longer qualify for protection after a review has taken place.[47] During this process, Williams posits that the same procedural and substantive factors as in the initial assessment apply.[48]

Notwithstanding that the majority of delisting decisions have been taken in response to species recovery, delisting is a likely and real response to species extinction given that the regime imposes economic and procedural obligations on states in relation to permits and licences, listing documents, recovery plans and legal fees. In other words, once they become extinct, species are likely to be delisted given the burdens arising from listing. Should newly extinct species lose their legal protection, there is no existing mechanism within the regime by which these protections could be revived and transferred to de-extinctees. Moreover, as already indicated,[49] it is questionable if de-extinctees would qualify for protections in their own right. Thus, a lacuna arises as to what protections (if any) should be offered to de-extinctees in the US context. Should protection be seen as warranted, a new system, or at least substantive amendments to the current system, would likely be needed.

4.1.2. Existing legal protection in the EU

In the EU, the Council Directive (EEC) 92/43 of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206 (Habitats Directive)[50] affords protection to the natural habitats of listed 'species of Community interest'. Such classification is afforded to species that are categorised as: endangered[51]; vulnerable and believed likely to become endangered in the near future if the causal factors continue operating[52]; rare, with small populations that are at risk of becoming endangered or vulnerable due to being located within restricted geographical areas or thinly scattered over a more extensive range[53]; or endemic and requiring particular attention by reason of the specific nature of their habitat, the potential impact of their exploitation on their habitat or the potential impact of their exploitation on their conservation status.[54]

The emphasis within this Directive is thus placed on endangerment. This means that, prior to its de-extinction, a long-extinct species would not fall within any protected category and would not benefit from any legal protection because these species have arguably gone past the point of endangerment to non-existence. It is also highly unlikely that a cloned animal from this species could be used to place such animals back within a category of endangerment, such as 'rare, with small populations'. To do so, the cloned animal would have to be seen as representative of the

46 ibid, s 4(c)(2).
47 Charles Sims and others 'Listing and Delisting Thresholds under the Endangered Species Act' (2017) 99 American Journal of Agricultural Economics 549.
48 Williams (n 37) 124.
49 See above, beginning of Section 4.1.1
50 Habitats Directive (n 28), art 2(2).
51 Except those species whose natural range is marginal in that territory, ibid, art 1(g)(i).
52 ibid, art 1(g)(ii).
53 ibid, art 1(g)(iii).
54 ibid, art 1(g)(iv).

extinct species (when it is merely a copy of one animal of that species) and be naturally existing (whereas it has been created via artificial intervention and lacks a natural habitat). It is likely, therefore, that existing systems which focus protection of endangered species on protecting their habitats would be of no or limited application in such contexts.

Unlike in the US, however, a newly extinct species which was previously protected by the Habitats Directive is more likely to continue to benefit from legal protection in the EU as a matter of practice, notwithstanding that it may no longer be eligible according to the applicable criteria. One reason for this is that any amendments necessary for updating Annexes I–VI on account of technical and scientific progress (or regress) must be adopted by the Council acting by qualified majority, and amendments for updating Annex IV must be adopted by the Council acting unanimously.[55] Evidently, some legislative effort is required in order to adhere to the structure of the regime and alter the lists contained within these Annexes.[56] This effort is made more significant as a result of the apparent unwillingness of the Member States to be responsive to changing circumstances and to make use of the flexibility and adaptability that there should be within this procedure.[57] For example, the inclusion of 'endemic' species, the precautionary undertones of other classified species and the broadly subjective notion of 'Community interest' have meant that the Annexes do not necessarily have to be (and have not always been) amended in practice. Further, there are no economic or procedural obligations directly imposed on the Member States by the EU comparable to those imposed on states in the US to incentivise the expenditure of Council time on such matters. Consequently, Pillai and Heptinstall have drawn attention to the relatively historical nature of the Annexes, citing the example of the continued protection afforded to the now recovered and abundant Eurasian Beaver—otherwise of 'least concern' on the IUCN Red List.[58] Arguments may therefore be made that de-extinctees could continue to benefit from existing legal protections for the extinct species in the EU context. However, given the environmental and epidemiological differences between cloned de-extinctees and extinct animals, it is questionable how successful such arguments will be.

4.2 Application for Legal Protection

Attempts to integrate all other de-extinctees, notably those created via back-breeding and genetic engineering, into the US and EU regimes is compromised by the perceived function and objectives of conservation in each of those jurisdictions. Significantly, the classification criteria applicable within each regime, some of which are expressed in similar terms, would likely accord different standards of legal protection to de-extinct species on account of their non-natural origins.

A remarkable feature of both the ESA 1973 and the Habitats Directive is that each regime invokes the notion of 'wildness' to demarcate its scope.[59] In this regard,

55 ibid, art 19.

56 Aylwin Pillai and David Heptinstall, 'Twenty Years of the Habitats Directive: A Case Study on Species Reintroduction, Protection and Management' (2013) 15 Environmental Law Review 27, 42–43.

57 ibid.

58 ibid.

59 ESA 1973 (n 28); Habitats Directive (n 28).

Oksanen and Vuorisalo provide an enlightening analysis of the notion of 'wildlife' and its applicability to artificially (re)produced de-extinct species.[60] On the one hand, the ESA 1973 does not appear to attach particular meaning to this notion: wildlife is defined to include 'all' members of the animal kingdom 'without limitation' and any products thereof.[61] Thus, unless there is a locational dimension to be attached to the 'animal kingdom', the term appears to be relatively broad. On the other hand, under the Habitats Directive, there is more scope to draw meaning from the notion of wildness. Unlike in the ESA 1973, no definition of 'wild flora and fauna' or species is provided. Rather the Habitats Directive is replete with references to 'in the wild' or 'from the wild',[62] which imply a locational dimension. There are also countless references to 'naturalness', most notably 'natural habitats'. These are defined to cover only the 'entirely natural' or 'semi-natural',[63] which implies a non-human or non-artificial dimension. The result is that a de-extinctee may not be eligible for listing in the EU by virtue of its non-natural origins, notwithstanding its low population and distribution, while other species such as Pillai and Heptinstall's Eurasian beaver remain listed even after they have been successfully naturally repopulated.[64]

Similar difficulties are encountered when one compares the types of habitats that fall within the rubric of these regulatory regimes. The ESA 1973 refers to 'critical' habitats, defined as the 'specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection'.[65] A critical habitat may otherwise be established for those species now listed as threatened or endangered species 'for which no critical habitat has heretofore been established'.[66] Such habitats will be those that fall within the 'range' of the species. Here, the scope of what constitutes a critical habitat is broad, with the capacity for the creation or establishment of a new habitat implying that it need not be entirely organic and free of human intervention and ecosystem engineering. By contrast, the Habitats Directive refers strictly to 'natural' habitats; the related language of 'native species' and 'natural range' appears to exclude the possibility of human intervention or ecosystem engineering, which may be required for the successful reintroduction of de-extinct species.[67]

5. CONCLUSION

Overall, this analysis demonstrates that de-extinction gives rise to myriad legal questions. Much will depend on how the technologies used for de-extinction

60 Markku Oksanen and Timo Vuorisalo, 'De-Extinct Species as Wildlife' (2017) 3 Finnish Journal for Human-Animal Studies 4.
61 ESA 1973, s 3(8) (n 28).
62 Habitats Directive (n 28), art 12(a) and (c).
63 ibid, art 1(b).
64 Pillai and Heptinstall (n 56) 27–46.
65 ESA 1973 (n 28), art 3(5)(A).
66 ibid, art 3(5)(B).
67 Habitats Directive (n 28), art 4.

develop, and the applicable frameworks will likely differ depending on which scientific technique—cloning, genetic engineering or back-breeding—is used in these efforts.

Furthermore, de-extinction poses new challenges for how species are categorised and understood in regulatory regimes. Taking nature conservation as an obvious site of potential regulatory control, it is apparent that the scientific processes used in de-extinction projects will impact the taxonomy and hence the legal status of a de-extinct species within a given regime. More precisely, it runs the risk of creating an oscillation between endangered, extinct and re-created species, which could have ramifications for nature conservation given its traditional focus on conserving species currently in existence. In effect, de-extinction attempts, if successful, will challenge the notion and significance of traditional legal cornerstones such as 'extinction', 'endangerment', 'naturalness' and 'wildness' as animals and de-extinctees oscillate between such concepts. These concepts are key to existing conservation frameworks and the scope of legal protection applicable within them. If it is possible to recreate extinct species, what then is the significance (if any) of attaching protection according to extinction risk? Legal questions in such contexts may shift to whether and how animals should be prioritised for de-extinction attempts. Moreover, certain de-extinction attempts, if intent upon rewilding, could threaten ecosystems for existing species and therefore raise difficult questions about how de-extinction and ecosystem survival should be negotiated in such contexts.

De-extinction also gives rise to broader normative questions. To what extent (if any) should legal protections be granted to de-extinctees? Should governments be under a duty to engage in de-extinction attempts for extinct animals? How should de-extinction be balanced with conservation projects in terms of funding and resources? How should legal protections be developed to facilitate regulatory priorities in terms of de-extinction and conservation attempts?

Thus, whilst for many, de-extinction provides an exciting vision of what humans can do to re-create extinct animals, to return our environment to a previous baseline or to facilitate significant commercial ventures,[68] for legal scholars, de-extinction poses complex legal questions that will need to be interrogated at length and across jurisdictions. 'Raising the dead', it seems, will raise 'a raft of legal and regulatory uncertainties'.[69]

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68 Tori Herridge, 'Mammoths Are a Huge Part of My Life. But Cloning Them Is Wrong' *The Guardian* (London, 18 November 2014); Carlin, Wurman and Zakim (n 22).

69 Virginia Gewin, 'Laws Lag Behind Science in De-extinction Debate' (*Discover Magazine*, 5 June 2013) <http://blogs.discovermagazine.com/crux/2013/06/05/laws-lag-behind-science-in-de-extinction-debate/#.WVSVcDOZOgQ> accessed 24 May 2017.

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