In the Era of *Jurassic Park*: Governing De-Extinction Through Soft Law

Molly Woodward*

> *"The world has just changed so radically, and we're all running to catch up. I don't want to jump to any conclusions, but look . . . . Dinosaurs and man, two species separated by sixty-five million years of evolution have just been suddenly thrown back into the mix together. How can we possibly have the slightest idea what to expect?"*[1]

INTRODUCTION

The *Jurassic Park* book and films tell an awe-inducing and ultimately horrific tale in which humans achieve a feat of genetic engineering and the height of hubris when they resurrect dinosaurs.[2] But raising extinct species from the dead using genetic engineering is no longer just a plot point for sci-fi and horror stories.[3] While dinosaurs are unlikely to be resurrected outside of fiction, tech-savvy scientists have successfully "resurrected" the dire wolf and continue to make strides toward bringing other species back from extinction.[4]

In March of 2025, Colossal Laboratories and Biosciences ("Colossal") introduced their three genetically engineered dire wolf pups to the world.[5] The dire wolf became extinct 10,000 years ago, but Colossal "revived" the

---

* J.D. Candidate, 2026, Sandra Day O'Connor College of Law at Arizona State University. This paper was originally submitted for the Standards, Soft Law and Industry Self-Regulation course at ASU Law. A special thank you to Professor Gary Marchant for his teaching and for his remarks on a draft of this paper during that course.

1. JURASSIC PARK (Universal Pictures 1993).
2. *See id.*; MICHAEL CRICHTON, JURASSIC PARK (1990).
3. *See* Hope M. Babcock, *The Genie Is Out of the De-Extinction Bottle: A Problem in Risk Regulation and Regulatory Gaps*, 37 VA. ENV'T L.J. 170, 170–71 (2019); Jeffrey Kluger, *Scientists Have Bred Woolly Mice on Their Journey to Bring Back the Mammoth*, TIME (Mar. 4, 2025), https://time.com/7264043/colossal-biosciences-woolly-mouse-bring-back-mammoth/ [https://perma.cc/67EK-E4ME].
4. *See* Babcock, *supra* note 3, at 176; Jeffrey Kluger, *The Return of the Dire Wolf*, TIME (Apr. 7, 2025), https://time.com/7274542/colossal-dire-wolf/ [https://perma.cc/SF7H-GTUU].
5. Kluger, *supra* note 4.

dire wolf pups by rewriting the common gray wolf's genetic code to reflect a dire wolf genome.[6] Colossal made more historic strides toward de-extinction earlier in 2025 when it announced the success of its woolly mice: mice genetically engineered to express traits of the extinct woolly mammoth, namely, the mammoth's fat metabolism and well-known shaggy coat.[7] Colossal collected genomes from mammoth remains preserved in permafrost, identified the genes that code for the mammoth's distinctive coat, and used the CRISPR-Cas 9 gene-editing tool to change mice's stem cells to express the mammoth's traits.[8] Colossal, "the world's first and only de-extinction company,"[9] hopes to resurrect the woolly mammoth as early as 2028.[10]

Colossal pursues de-extinction with the noble intention of restoring extinct species and preventing further extinction across the planet,[11] but de-extinction is an emerging technology with an uncertain future, including uncertain risks and uncertain regulation.[12] To reap de-extinction's benefits and mitigate its potential risks, adequate governance through soft law instruments is necessary.

This paper conveys the necessity and appropriateness of using soft law to govern de-extinction. Part I provides readers with an understanding of what de-extinction is. Part II discusses de-extinction's potential benefits and risks. Part III argues de-extinction should be regulated by soft law instruments. This argument proceeds in three parts: first, existing soft law instruments within the de-extinction space are described; second, soft law's suitability for addressing de-extinction is explained; third, the shortfalls of soft law approaches and ways to mitigate those drawbacks are discussed. Altogether, this paper presents a strong case for governing de-extinction through soft law.

I. WHAT IS DE-EXTINCTION?

De-extinction, or "resurrection biology," is the process of resurrecting species from extinction.[13] Colossal defines de-extinction as the "functional

---

6. *Id.*
7. *See* Kluger, *supra* note 3.
8. *Id.*
9. *De-Extinction: Disruptive Conservation & Preservation*, COLOSSAL LAB'YS & BIOSCIENCES, https://colossal.com/de-extinction/ [https://perma.cc/UD5X-SXZS].
10. Kluger, *supra* note 3.
11. *De-Extinction: Disruptive Conservation & Preservation*, *supra* note 9.
12. *See* Babcock, *supra* note 3, at 178–82.
13. *Id.* at 174; Jessica Allen et al., *De-Extinction, Regulation and Nature Conservation*, 32 J. ENV'T L. 309, 310 (2020); *see* Sara Ord, *How De-Extinction Works: Methods, Examples and*

application of advanced gene editing technology aimed at rebuilding the DNA of lost megafauna and other creatures that had a measurably positive impact on our fragile ecosystems."[14] Under the International Union for the Conservation of Nature's ("IUCN") working definition, de-extinction is "the generation of proxies of extinct species that are functionally equivalent to the original extinct species but are not 'faithful replicas.'"[15] These proxies are not "faithful replicas" because de-extinction processes are only able to "recover" the extinct species by altering existing species to mimic the target species.[16]

De-extinction ultimately requires resurrecting a sufficiently large population of the once-extinct species and reintroducing them into the wild.[17] The first step towards de-extinction, however, is resurrecting one member—technically, its proxy—of the extinct species.[18] Three different methods may achieve this first step: selective breeding, cloning, or genome editing.[19]

Selective breeding (or "back-breeding") "resurrects" a member of an extinct species by breeding an animal physically similar to the extinct species.[20] This physical similarity is attained by selectively breeding similar animals across several generations until they present the desired characteristics.[21] This method is currently being employed by the Tauros Programme to recover European auroch populations.[22]

Cloning achieves de-extinction by genetically replicating the extinct species.[23] Such genetic replication requires high-quality DNA from the extinct species, limiting when this method can be used.[24] The extinct animal's DNA replaces the DNA of another animal's unfertilized egg cells through somatic cell nuclear transfer.[25] These egg cells are then implanted into a surrogate mother from a related species.[26] The clones created through this

---

Step-by-Step Process, COLOSSAL LAB'YS & BIOSCIENCES, https://colossal.com/how-de-extinction-works/ [https://perma.cc/RPL5-6PVQ].

14. COLOSSAL LAB'YS & BIOSCIENCES, https://colossal.com/ [https://perma.cc/3L5A-V9MK].

15. Ben Jacob Novak, *De-Extinction*, GENES, Nov. 2018, at 1, 2, https://www.mdpi.com/2073-4425/9/11/548 [https://perma.cc/679Z-KD2J].

16. *See id.*

17. Babcock, *supra* note 3, at 177–78.

18. *See id.*

19. Allen et al., *supra* note 13, at 310.

20. *Id.*

21. *Id.*

22. *Id.* at 311.

23. *Id.* at 310.

24. *Id.*

25. Norman F. Carlin et al., *How to Permit Your Mammoth: Some Legal Implications of "De-Extinction"*, 33 STAN. ENV'T L.J. 3, 8 (2014).

26. Babcock, *supra* note 3, at 175.

somatic cell nuclear transfer are not true replicas of the extinct species, however, because of epigenetic differences distinguishing the proxies from the extinct species.[27] Cloning works best with recently extinct species who have a closely related and still-living species (or subspecies), the latter of which serves as the surrogate mother for this process.[28] Cloning may seem like a far-fetched goal, but this method has already seen limited success.[29] One member of the extinct Pyrenean ibex species was successfully cloned in 2003, though it died eleven minutes after its birth due to a lung defect.[30]

The last method of de-extinction, and the one employed by Colossal,[31] is genome editing or genetic engineering.[32] Genome editing involves manipulating embryos of animals similar to the extinct animal at the cellular level.[33] One example of embryo manipulation is gene-splicing, which incorporates extinct species' gene sequences into the similar species' genome.[34] CRISPR-Cas 9 technology can also modify reproductive cells' DNA from the related species by selecting, deleting, and replacing part of the DNA sequence with a "different, pre-selected, and pre-created sequence."[35]

These genetically rewritten embryos are then implanted into a surrogate animal who, if the process succeeds, will birth an extinct animal's proxy.[36] Notably, the CRISPR-Cas 9 technology manipulations are heritable, meaning they will pass on to any offspring.[37] The end-product of this process is ultimately a hybridized proxy of the extinct animal.[38] This gene-editing method of de-extinction was used to create Colossal's woolly mammoth mice and dire wolves.[39] Colossal intends to eventually use this method on elephants to create woolly mammoths.[40] With ongoing de-extinction projects like those Colossal is leading, successful de-extinction of entire species is an

---

27. Novak, *supra* note 15, at 549.
28. Carlin et al., *supra* note 25, at 8.
29. *See* Allen et al., *supra* note 13, at 311, 313.
30. *Id.* at 311.
31. *See* Kluger, *supra* note 3.
32. Babcock, *supra* note 3, at 175–76.
33. Allen et al., *supra* note 13, at 310.
34. Babcock, *supra* note 3, at 176.
35. *Id.* (quoting Brooke Elizabeth Hrouda, *"Playing God?": An Examination of the Legality of CRISPR Germline Editing Technology Under the Current International Regulatory Scheme and the Universal Declaration on the Human Genome and Human Rights*, 45 GA. J. INT'L & COMPAR. L. 221, 226 (2016)).
36. *See id.* at 176–77.
37. *Id.* at 177.
38. *See* Allen et al., *supra* note 13, at 310.
39. *See* Kluger, *supra* note 3; Kluger, *supra* note 4.
40. *See* Allen et al., *supra* note 13, at 311.

inevitability,[41] but the technology's benefits and risks are still largely uncertain and debated.

II. DE-EXTINCTION'S IMPLICATIONS

Like other emerging technologies, the full and exact implications of de-extinction's success remain uncertain.[42] As a result, de-extinction is cultivating a future full of possible rewards and risks.[43]

A. Rewards

Successful de-extinction efforts offer robust benefits, but the most notable of these benefits is de-extinction's potential as a conservation tool.[44] De-extinction can not only resurrect an entire species but may consequentially reinvigorate entire ecosystems.[45] This is likely where the resurrected species was an ecosystem's keystone species and is reintroduced to that ecosystem.[46] By resurrecting and re-introducing a keystone species, de-extinction facilitates the ecosystem's recovery of its functionality and integrity.[47] De-extinction technologies may also save endangered species from extinction.[48] De-extinction may act as a "fail-safe" to other conservation efforts by using its cloning and gene-editing techniques to prevent further species extinction.[49] Cloning can rescue endangered species "when only a few or no reproducing individuals remain," while gene-editing technology can increase genetic diversity among endangered species or improve the endangered species' survival capabilities by adding genes to their genomes.[50]

---

41. Babcock, *supra* note 3, at 195.

42. *See, e.g.*, Gary Marchant et al., *Governing Emerging Technologies Through Soft Law: Lessons for Artificial Intelligence*, 61 JURIMETRICS J. 1, 4 (2020) (discussing the uncertain "benefits, risks, and future trajectories of AI").

43. SPECIES SURVIVAL COMM'N, INT'L UNION FOR CONSERVATION OF NATURE, GUIDING PRINCIPLES ON CREATING PROXIES OF EXTINCT SPECIES FOR CONSERVATION BENEFIT 7–9 (2016) [hereinafter IUCN SSC].

44. *See* Phillip J. Seddon et al., *Reintroducing Resurrected Species: Selecting DeExtinction Candidates*, 29 TRENDS ECOLOGY & EVOLUTION 140, 141 (2014).

45. Babcock, *supra* note 3, at 182.

46. *Id.* at 182–83.

47. *Id.* at 183.

48. *See* Allen et al., *supra* note 13, at 321.

49. Babcock, *supra* note 3, at 182–83.

50. *Id.*

Though conservation goals are currently the heart of de-extinction efforts, its benefits extend beyond the scope of conservation.[51] De-extinction may serve as a tool for justice and fulfill moral obligations by reviving species humans had a hand in driving to extinction.[52] De-extinction also benefits the greater scientific and technological communities by allowing an unparalleled opportunity for scientists to study once-extinct species and to push technology to new heights.[53] De-extinction has broader benefits for humanity, as well, by invoking a sense of awe and wonder.[54]

B. Risks

Despite its potential rewards, de-extinction and its uncertainties also pose many risks.[55] Among these risks is the potential for resurrected species' endangerment after reintroduction to their natural habitat.[56] Many changes may have occurred since the species' extinction: the species' food supply may have been lost, new predators or diseases may have arisen, and climate change may have affected the carrying capacity of the species' habitat.[57] Thus, resurrecting a species may actually place them in a position to face extinction once again.[58]

The resurrected species themselves may also pose a risk to the environment or to other species.[59] Resurrected species may carry unanticipated diseases, negatively disrupt ecosystems' existing food chains by killing prey, or threaten other species' survival by outperforming these other species.[60]

Some scholars argue that re-introducing resurrected species is akin to introducing invasive species to an ecosystem.[61] Since "[a]ny reintroduction of a species, whether resurrected or existing elsewhere, risks 'disrupting receiving biological communities,'" de-extinction may hurt the biological community rather than benefit it.[62] The human environment is also potentially

---

51. *See id.* at 182–84; Seddon et al., *supra* note 44, at 141; IUCN SSC, *supra* note 43, at 7.
52. Babcock, *supra* note 3, at 183.
53. *See id.* at 182; IUCN SSC, *supra* note 43, at 7.
54. *See* Babcock, *supra* note 3, at 182.
55. *See* IUCN SSC, *supra* note 43, at 8–9.
56. Babcock, *supra* note 3, at 178–79.
57. *Id.* at 179.
58. *See id.* at 178–79.
59. *Id.* at 180–81.
60. *Id.*
61. *Id.* at 181.
62. *Id.* (quoting Alejandro E. Camacho, *Going the Way of the Dodo: De-Extinction, Dualisms, and Reframing Conservation*, 92 WASH. U. L. REV. 849, 860 (2015)).

endangered because of the threat reintroduced species may pose to agricultural, fishing, and livestock industries, and the environments they operate in.[63] Furthermore, de-extinction may erode conservation efforts by creating a false sense of security and disinclining individuals and agencies from urgent conservation efforts.[64] Similarly, de-extinction may also divert resources currently devoted to protecting other endangered species.[65]

Labeled an "unnatural and hubristic" act,[66] de-extinction also poses moral and ethical concerns.[67] Among these concerns is the possibility that de-extinction will lead to animal cruelty or threaten animal welfare,[68] especially since prior cloning efforts have ended in resurrected animals dying from birth defects.[69] Some scholars raise theological concerns, questioning the right to "[p]lay God" and to selectively determine what species should be brought back from death.[70]

Finally, de-extinction has the potential for misuse.[71] Though currently posited as a conservation tool,[72] there is no question that bringing back beloved species like the woolly mammoth has significant commercial potential.[73] Some argue that commercializing de-extinction is an abuse of the technology.[74] There are also concerns that resurrected species may become a geopolitical weapon.[75] Using animals for geopolitical power is not unheard of.[76] For instance, China uses its pandas as a tool for diplomatic relations, especially with Western nations.[77] Already, President Vladimir Putin has expressed interest in capitalizing on the woolly mammoth by creating a Pleistocene Park in Russia, a theme park reminiscent of Jurassic Park.[78] Given

---

63. *Id.*
64. *Id.* at 179.
65. *Id.*
66. *Id.* at 183 (quoting Erin Okuno, *Frankenstein's Mammoth: Anticipating the Global Legal Framework for De-Extinction*, 43 ECOLOGY L.Q. 581, 589 (2016)).
67. *See id.* at 183–84; Allen et al., *supra* note 13, at 310–11.
68. Babcock, *supra* note 3, at 184.
69. *See* Allen et al., *supra* note 13, at 311.
70. Gareth Thomas Richards, To What Extent Can De-Extinction be Theologically and Morally Justified? 8 (June 2022) (MRes. thesis, University of Exeter) (ProQuest).
71. *See* Allen et al., *supra* note 13, at 313.
72. *See* COLOSSAL LAB'YS & BIOSCIENCES, *supra* note 14; Babcock, *supra* note 3, at 182 n.94.
73. *See* Allen et al., *supra* note 13, at 313.
74. *See id.*
75. *Id.*
76. *Id.*
77. *Id.*
78. *Id.*

these many uncertainties and risks, de-extinction requires appropriate governance.

III. GOVERNING DE-EXTINCTION THROUGH SOFT LAW

De-extinction is an emerging technology with an uncertain future, yet it is "critically under-regulated."[79] This regulatory void may be filled through hard law or soft law approaches, or a combination of both.[80] "Hard law" refers to more traditional regulatory approaches that are legally binding and directly enforceable.[81] Hard law is typically implemented when cooperation gains, opportunism chances, and opportunism costs are high.[82] In contrast to hard law, "soft law" refers to "instruments or arrangements that create substantive expectations that are not directly enforceable."[83] In sum, soft law is an ex-ante, permissive alternative to formal governance approaches.[84] Methods for implementing soft law include private standards, codes of conduct, principles, or guidelines.[85] As discussed below, not only do soft law instruments governing de-extinction already exist, soft law is the best, even necessary, approach to governing de-extinction efforts, and any potential flaws in soft law governance may be alleviated through careful countermeasures.

A. Existing Soft Law Instruments

Soft law approaches governing de-extinction already exist.[86] The IUCN SSC Guiding Principles on Creating Proxies of Extinct Species for Conservation Benefit ("IUCN Guidelines") is one such soft law instrument.[87]

---

79. Babcock, *supra* note 3, at 184.

80. *See* Gregory C. Shaffer & Mark A. Pollack, *Hard vs. Soft Law: Alternatives, Complements, and Antagonists in International Governance*, 94 MINN. L. REV. 706, 721 (2010).

81. *Id.* at 714–15.

82. *Id.* at 718.

83. Gary E. Marchant & Brad Allenby, *Soft Law: New Tools for Governing Emerging Technologies*, 73 BULL. ATOMIC SCIENTISTS 108, 112 (2017).

84. Gary E. Marchant, *Governance of Emerging Technologies as a Wicked Problem*, 73 VAND. L. REV. 1861, 1866 (2020).

85. Marchant & Allenby, *supra* note 83, at 112.

86. *See* IUCN SSC, *supra* note 43, at 10–12 (setting forth guiding principles for the creation of proxies of extinct species); CTR. FOR VETERINARY MED., U.S. DEP'T OF HEALTH & HUM. SERVS., HERITABLE INTENTIONAL GENOMIC ALTERATIONS IN ANIMALS: RISK-BASED APPROACH 4–10 (2024), https://www.fda.gov/media/74614/download (providing the FDA's guidance as to heritable intentional genomic alterations in animals).

87. *See* IUCN SSC, *supra* note 43.

While defining "de-extinction," the IUCN Guidelines emphasize that de-extinction's priority is conservation and should only be undertaken when "consistent with preserving existing biodiversity."[88] The IUCN Guidelines primarily address how proxy species are to be appropriately released, recommending substantial evaluations of the proxy species and its readiness for translocation and other risk-averse steps in evaluating the proper translocation procedures and locations.[89] A notable drawback of the IUCN Guidelines, and a soft law flaw that will be further discussed,[90] is the lack of an enforcement mechanism.[91]

Another soft law instrument for de-extinction governance is the Food and Drug Administration's ("FDA") industry guidance, Heritable Intentional Genomic Alterations in Animals: Risk-Based Approach ("IGA Guidelines").[92] The IGA Guidelines are non-enforceable, and industry actors may "use an alternative approach if it satisfies the requirements of the applicable statutes and regulations."[93] The IGA Guidelines define three categories of risk for intentional genomic alterations ("IGA") in animals.[94] The IGA's risk category determines the degree of FDA review and approval required for the IGAs in animals: Category 1 IGAs require no consultation with the FDA; Category 2 IGAs are subject to FDA review; and Category 3 IGAs, the high risk category, require FDA review and approval.[95]

Soft law approaches like these must continue to govern, and more should be developed to govern de-extinction. These soft law approaches are not only best suited for governing de-extinction governance but also necessary for a comprehensive governance approach that hard law cannot attain on its own.

---

88. *Id.* at 2.

89. *Id.* at 10–11.

90. *See* discussion *infra* Section III.C.

91. *See* IUCN SSC, *supra* note 43, at 10–12 (providing only guiding principles and further recommending the implementation of enforcement mechanisms).

92. *See* CTR. FOR VETERINARY MED., *supra* note 86. The FDA has a history of implementing and relying on soft law criteria. Ryan Hagemann, *New Rules for New Frontiers: Regulating Emerging Technologies in an Era of Soft Law*, 57 WASHBURN L.J. 235, 244–45 (2018).

93. CTR. FOR VETERINARY MED., *supra* note 86, at 1. This non-exclusivity may even encourage further development of de-extinction industry standards. *See id.*

94. *Id.* at 4.

95. *Id.*

B. The Need for Soft Law in De-Extinction

Soft law is necessary for comprehensive and adequate de-extinction governance because, unlike hard law: (1) soft law can address the pacing problem; (2) soft law is not confined to a regulatory agency or jurisdiction; (3) and soft law can address ethical concerns.

1. The Pacing Problem

De-extinction technology is quickly outpacing the regulation development process, thereby necessitating soft law approaches.[96] Like other emerging technologies, "[t]he process of creating de-extinct animals using genetic engineering is moving forward rapidly."[97] Market competition and demands will continue encouraging emerging technologies like those used in de-extinction to develop faster, to be put out on the market faster, and to improve faster.[98] While these incessant demands are spurring faster technological development, regulation's development is chilled by glacial legislation, regulation, and judicial review.[99]

The increased number of bureaucratic hoops in addition to technology's increased politicization slows regulation development.[100] The consequence of this pacing problem is that "regulations affecting these new technologies are likely to be outdated before the ink dries."[101] Thus, either regulations for de-extinction will inadequately address the technology or regulators will attempt to wait to regulate until "a more stable technology plateau" occurs, which is not guaranteed.[102] Soft law, unlike hard law, is more malleable and readily

96. *See* Babcock, *supra* note 3, at 195.

97. *Id.*

98. *See* Marchant, *supra* note 84, at 1863.

99. *Id.*

100. *Id.*

101. *Id.* at 1864. The pacing problem is apparent when considering how existing hard law instruments would regulate (or *fail* to regulate) de-extinction. *See* Babcock, *supra* note 3, at 186–87. Though the Endangered Species Act would likely apply to de-extinction, its application "would be so contrary to the law's expected application that it would stretch its original meaning beyond any recognizable interpretation." *Id.* at 186. Similarly, the Wilderness Act of 1964 would hinder de-extinction efforts given its likelihood of finding de-extinct species to be invasive or exotic species. *Id.* at 186–87. These regulatory authorities have not kept pace with de-extinction realities, and reformations are unlikely. *See id.*

102. Marchant, *supra* note 84, at 1864.

adaptable to new information and changed circumstances.[103] This allows soft law to address de-extinction's rapid progression and evolution.[104]

2. A Multi-Disciplinary and Transnational Nature

Soft law is also not confined to a specific regulatory agency nor a single jurisdiction, allowing it to address two unique aspects of de-extinction: (1) its multi-disciplinary nature[105] and (2) its inherent transnational nature.[106]

First, unlike hard law,[107] soft law can address de-extinction's complex intersection of biology, technology, conservation, and intellectual property disciplines.[108] This multi-disciplinary character presents a challenge for hard law because it implicates a "regulatory commons" problem by which multiple regulatory agencies have potential authority over parts of the issue, but no single primary regulator exists.[109] The lack of a regulatory leader increases the opportunity for oversight gaps from regulatory schemes that tend to overlap and contradict each other.[110] The result is a fragmented framework hesitant to regulate because of high transaction costs from coordinating with other agencies, the risk of being assigned blame for social ills arising out of the area of regulation, and free rider problems.[111] For these reasons, hard law tends to offer poor governance approaches to issues like de-extinction that are multidisciplinary in nature and possibly subject to the regulatory commons problem.[112]

---

103. Marchant et al., *supra* note 42, at 7.

104. *See* Babcock, *supra* note 3, at 195.

105. *See* Marchant et al., *supra* note 42, at 7–8; Marchant, *supra* note 84, at 1864, 1867; Rene X. Valdez et al., *Anticipating Risks, Governance Needs, and Public Perceptions of De-Extinction*, 6 J. RESPONSIBLE INNOVATION 211, 226 (2019) (discussing many disciplines that are involved in de-extinction and proposing a collaborative, multi-disciplinary approach to regulation).

106. *See* Erin Okuno, *Frankenstein's Mammoth: Anticipating the Global Legal Framework for De-Extinction*, 43 ECOLOGY L.Q. 581, 592–93 (2016).

107. *See* Valdez et al., *supra* note 105, at 225; *see also* Marchant et al., *supra* note 42, at 7–8.

108. *See* Marchant et al., *supra* note 42, at 7–8; *see also* Gary E. Marchant & Kenneth W. Abbott, *International Harmonization of Nanotechnology Through Soft Law Approaches*, 9 NANOTECH. L. & BUS. 393, 398 (2013).

109. *See* William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 IOWA L. REV. 1, 5–6 (2003).

110. Babcock, *supra* note 3, at 193.

111. *Id.* at 194.

112. *See id.* at 193–94.

Since soft law is not restricted to a specific regulatory agency, it can address de-extinction's complex multi-disciplinary nature.[113] Different stakeholders, such as experts from biology, technology, conservation, and environmental protection disciplines, can come together under a soft law framework to appropriately and effectively govern de-extinction.[114] Soft law's characterization as a voluntary governance framework encourages such an approach.[115] Also, the ability for industry stakeholders and experts to directly participate in soft law development is particularly beneficial for de-extinction because non-experts may be more susceptible to "fictional representations of science" and its risks, like those presented in *Jurassic Park*.[116]

It is important to note that the regulatory commons problem for de-extinction is mitigated by the FDA's asserted jurisdiction over animals with IGAs, specifically those to be released in the wild.[117] Given de-extinction's use of IGAs through emerging technology, such as CRISPR-Cas 9, the FDA likely has jurisdiction over de-extinct animals.[118] Thus, the FDA has asserted itself as a primary regulator,[119] and, to the extent of the FDA's regulatory authority over de-extinction, the regulatory commons problem lies dormant.

Second, soft law is able to address de-extinction's inherent transnational nature.[120] De-extinction involves the resurrection of animal species, and "animals . . . do not respect national borders."[121] For instance, many viable candidates for de-extinction have habitats or migration routes that transcend national borders.[122] Some examples of these candidates' transnational nature include the passenger pigeons that range across the United States and Canada, and the great auk's distribution across Canada, the United States, Greenland, Iceland, and other countries.[123] Even without considering the historical range

---

113. *See* Marchant et al., *supra* note 42, at 7; Marchant, *supra* note 84, at 1864, 1867; Valdez et al., *supra* note 105, at 226.

114. *See* Marchant et al., *supra* note 42, at 7–8; Marchant & Abbott, *supra* note 108, at 398.

115. Marchant, *supra* note 84, at 1867.

116. Valdez et al., *supra* note 105, at 224. The concerns of non-experts' susceptibility to "fictional representations of science" may be part of the stereotype that non-experts are generally less rational. *Id.*

117. U.S. FOOD & DRUG ADMIN., MOU 225-24-010: MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF AGRICULTURE AND THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES FOOD AND DRUG ADMINISTRATION (2024), https://www.fda.gov/about-fda/domestic-mous/mou-225-24-010.

118. *See id.*; Babcock, *supra* note 3, at 176.

119. *See* Buzbee, *supra* note 109, at 27.

120. *See* Marchant et al., *supra* note 42, at 8; Okuno, *supra* note 106, at 592.

121. Okuno, *supra* note 106, at 592.

122. *Id.* at 593.

123. *Id.*

of de-extinction candidate species, it is inevitable that resurrected species will cross national boundaries wherever they are reintroduced.[124] As such, hard law, which is limited in jurisdiction, is incapable of satisfactorily governing de-extinction on its own.[125] On the other hand, soft law's freedom from jurisdictional constraints makes it capable of addressing de-extinction's transnationality.[126]

3. Ethical Concerns

De-extinction and its efforts to raise the dead also raise ethical, moral, and even theological issues.[127] These concerns tend to fall "outside the safety and efficacy scope of current agency jurisdictions."[128] As a result, these ethical concerns remain untouched by hard law's regulations.[129] Unlike its counterpart, soft law's aptness for multi-stakeholder approaches makes it uniquely capable of addressing these moral, ethical, and even theological concerns.[130]

Soft law is already used in stem cell research to address ethical concerns.[131] For example, the International Society of Stem Cell Research offers ethical guidelines for stem cell researchers.[132] A similar approach may be applied to de-extinction, and professional guidelines for de-extinction researchers or conservationists may be implemented. Hard law's inability to address de-extinction's pacing problem, multi-disciplinary and transnational nature, and ethical concerns, suggests soft law is necessary for adequate de-extinction governance. The necessity of soft law, however, does not mean soft law is a perfect governance approach.

C. Addressing the Flaws of Applying Soft Law to De-Extinction

Soft law is not without its flaws. As soft law is voluntary, direct enforcement and guaranteed compliance are not possible.[133] A possible remedy to this weakness is to condition publication in top scientific journals

---

124. *Id.*
125. *See* Babcock, *supra* note 3, at 184–85.
126. *See* Marchant et al., *supra* note 42, at 8; Okuno, *supra* note 106, at 592.
127. *See* Babcock, *supra* note 3, at 183–84; Allen et al., *supra* note 13, at 311.
128. Marchant, *supra* note 84, at 1864.
129. *Id.*
130. *Id.* at 1867.
131. Marchant & Allenby, *supra* note 83, at 112–13.
132. *Id.*
133. Marchant, *supra* note 84, at 1867.

on conformance with soft law guidelines.[134] This enforcement approach is already applied in the context of stem cell research.[135] The *Nature* journals condition publication of stem cell or human genome editing articles on compliance with the International Society for Stem Cell Research Guidelines for Stem Cells.[136] Highly regarded journals could similarly condition publication of de-extinction articles and research on conformance with de-extinction guidelines, such as the IUCN guidelines.[137]

Soft law is also prone to excessive generality or vagueness.[138] One potential consequence is that soft law may not be impactful. Companies may take advantage of a soft law instrument's vague terms to claim they complied with the soft law instrument, gaining positive public opinions while failing to implement any fundamental changes within their business.[139] Additionally, interested parties may be excluded from the soft law instruments' development.[140] Public confidence, or the lack thereof, is another drawback of soft law. The public's opinion of soft law reveals an absence of confidence and trust that soft law is capable of and is actively addressing the problem at hand.[141] Certification, auditing processes, or oversight by credible non-governmental organizations may remedy these concerns.[142]

Despite these flaws, soft law remains the more available and appropriate governance framework for de-extinction. However, the choice between governing de-extinction through soft law or hard law need not be a binary one.[143] Rather, soft law and hard law can serve as compliments in which soft law can serve as a stepping stone to hard law and/or work in tandem with hard law as its supplement.[144] Hard law may also be used as the vessel by which soft law compliance is reached.[145] Co-governance by soft law and hard law can offer a more comprehensive governance approach and can remedy the disadvantages of soft law.[146]

---

134. *See* Gary E. Marchant & Carlos Ignacio Gutierrez, *Soft Law 2.0: An Agile and Effective Governance Approach for Artificial Intelligence*, 24 MINN. J.L. SCI. & TECH. 375, 421–22 (2023).
135. *Id.* at 421.
136. *Id.*
137. *See* IUCN SSC, *supra* note 43.
138. Marchant, *supra* note 84, at 1867.
139. *Id.* at 1867 & n.27.
140. *See id.* at 1867.
141. *Id.* at 1867–68.
142. *Id.*
143. Shaffer & Pollack, *supra* note 80, at 721.
144. *Id.*
145. *See* Oliver Feeney et al., *Ethics, Patents and Genome Editing: A Critical Assessment of Three Options of Technology Governance*, FRONTIERS POL. SCI., Sept. 2021, at 1, 4.
146. *See* Shaffer & Pollack, *supra* note 80, at 721.

One example of this more coordinated governance approach is the use of patent law (hard law) to encourage compliance with ethical guidelines (soft law).[147] Companies with patents for a technology may "require or forbid certain practices" by incorporating ethical constraints within the licensing agreement.[148] For example, this "ethical licensing," has been used with CRISPR technology.[149] Broad Institute's CRISPR-Cas 9 license expressly prohibits using the technology for "editing of tobacco plants, with gene drives or for creating 'terminator' seeds for agriculture."[150] De-extinction technology, possibly subject to patent law, may similarly incorporate ethical licensing techniques, harmonizing soft law and hard law governance approaches.[151]

Therefore, while soft law is likely necessary to govern de-extinction and hard law is likely insufficient to regulate de-extinction alone, both governance approaches can and should be brought together to create a comprehensive governance framework for de-extinction.

IV. CONCLUSION

Though there may be no Jurassic Park in the future, de-extinction has already revived the dire wolves,[152] and its continued success is an inevitability.[153] De-extinction will likely serve as a powerful conservation tool, able to better protect endangered species and ecosystems across the planet.[154] With its many uncertainties, however, de-extinction also poses numerous risks.[155] Given these risks, de-extinction governance is necessary, yet de-extinction is currently "going forward unregulated."[156] Both soft law and hard law governance approaches may fill this regulatory void, but soft law is more suitable for de-extinction than hard law.[157] Unlike hard law, soft law governance can address de-extinction's pacing problem, its complexity as a multi-disciplinary technology, its uncertain nature that is prone to

---

147. Feeney et al., *supra* note 145, at 4.
148. *Id.*
149. *Id.*
150. *Id.*
151. *See* Feeney et al., *supra* note 145, at 4; Okuno, *supra* note 106, at 618–20.
152. Kluger, *supra* note 4.
153. Babcock, *supra* note 3, at 195.
154. IUCN SSC, *supra* note 43, at 7.
155. *See supra* Section II.B.
156. Babcock, *supra* note 3, at 195.
157. *See supra* Section III.B.

change, and its inherent transnationality.[158] Soft law is imperfect, however, and hard law, though insufficient to regulate de-extinction alone, should be incorporated into de-extinction's governance framework.[159]

---

158. *See supra* Section III.B.
159. *See supra* Section III.C.