Make Room for the Mushroom: Legal Vehicles for Conservation of the Kingdom Fungi

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I. Introduction

Species in the fungi kingdom are numerous, diverse, and serve many ecosystem services such as nutrient cycling, decomposition, providing food for other species, and bio-regulating their ecosystems.[1] Fungi contribute to expansive soil diversity– there are a conservatively estimated 1.5 million species in the kingdom, including mushrooms, yeasts, lichens, and mildews.[2] These species can be helpful to humans, as they are used for medicinal research, agriculture, and forestry.[3] Many fungal

1. Wei Fang et al., *Systematic Review of Fungi, Their Diversity and Role in Ecosystem Services from the Far Eastern Himalayan Landscape (FHL)*, 9 Heliyon, e12756, Jan. 2023, at 3.

2. Lynn Margulis & Michael J. Chapman, Kingdom and Domains, 379–409 (4th ed. 2009); It's suggested there could be as many as 3.8 million fungal species. David L. Hawksworth & Robert Lücking, *Fungal Diversity Revisited: 2.2 to 3.8 Million Species*, Microbiology Spectrum, July 28, 2017, at 13.

3. *See* Tom W. May et al., *Recognition of the Discipline of Conservation Mycology*, 33 Conservation Biology 733, 734 (2018).

species are at risk as, like other species, their habitat is being razed by developments, altered by climate change, and destroyed by pollution.[4]

Nonetheless, despite Congress previously protecting scientific curiosities and endangered species, conservation of fungal species is absent from almost all federal protection schemes, such as the Endangered Species Act (ESA) and most land management resource conservation regulations and policies.[5] Finally, individual states, counties, and cities that have enacted their own laws, regulations, and policies have also largely failed to protect fungi species.

This comment proceeds in four parts. First, I will exhibit why species in the Kingdom Fungi should be protected due to their medicinal potential and scientific curiosities. Second, I will explore how different federal vehicles for species conservation—including the ESA and individual land management agency regulations—could and do include fungal species. Third, I will briefly discuss individual states' efforts to protect fungal species. Finally, I will provide recommendations for future actions to better protect species in the Kingdom Fungi.

II. Background on the Kingdom Fungi

Species in the fungi kingdom are diverse, largely unknown, and contribute to many human uses. The two most compelling reasons for protecting fungal species are to preserve the biodiversity of endangered and threatened species and to ensure that even non-endangered species can continue providing ecosystem services in their habitats.[6]

Fungi species play a marked role in their ecosystems and in humans' lives. In 1929, Alexander Fleming used a mold species to develop penicillin, which saved hundreds of millions of human lives.[7] The largest organism in the world is arguably a network of Honey Fungi that spans approximately 2,384 acres of soil in Oregon.[8] We use fungi and their processes for food, medicine, agriculture, religious significance, and recreational drugs, among other uses.[9] For thousands of years, humans have

4. Lynne Boddy et al., *Climate Variation Effects on Fungal Fruiting*, 10 Fungal Ecology 20 (2013); Sarah Gibbens, *Fungi Are Key to Our Survival. Are We Doing Enough to Protect Them?*, Nat'l Geographic (Mar. 18, 2021), https://www.nationalgeographic.com/environment/article/fungi-are-key-to-survival-are-we-doing-enough-to-protect-them? [https://perma.cc/GX6E-K6SR].

5. *See generally* Antiquities Act of 1906, 54 U.S.C §§ 320301–320303; Endangered Species Act, 16 U.S.C. §§ 1531–1544.

6. Both of these reasons focus on anthropocentric uses, such as preserving genetic variations for future research and benefitting from the ecosystem services they provide, however, other reasons to conserve natural resources and preserve biodiversity can derive from placing inherent value in living beings.

7. *How was Penicillin Developed?*, Sci. Museum (Feb. 23, 2021), https://www.sciencemuseum.org.uk/objects-and-stories/how-was-penicillin-developed#:~:text=1928%20to%201929,chemical%20that%20could%20kill%20bacteria [https://perma.cc/4H5D-MPBY].

8. Anne Casselman, *The Largest Organism on Earth Is a Fungus*, Sci. Am. (Oct. 4, 2007), https://www.scientificamerican.com/article/strange-but-true-largest-organism-is-fungus/ [https://perma.cc/2L5T-4LRN].

9. Naveed Davoodian, *Fungal Conservation in the United States: Current Status of Federal Frameworks*, 24 Springer 2099, 2099–00 (2015); R.C. Van Court et al., *Diversity, Biology, and History of Psilocybin-Containing Fungi: Suggestions for Research and Technological Development*, 126 Fungal Biology 308, 308–09 (2022) (documenting the extensive traditional use of *Psilocybe*

used yeast species to ferment cheeses, breads, and alcohols.[10] Fungi also provide essential ecosystem services that help to fight against climate change and contribute to essential soil structure.[11] The following survey of the role fungi play in our lives provides a glimpse into an entire taxonomic Kingdom we might take for granted.

In the upper part of forest soils, saprotrophic fungi decompose dead biologic matter, while in the deeper portion, mycorrhizal fungi connect with the ends of roots and extend their intake of water and nutrients.[12] These fungi networks sequester and cycle carbon, mitigating climate change by providing a sink for carbon dioxide, a greenhouse gas.[13] Additionally, fungal species in the soil help to sustain plant productivity by cycling essential nutrients such as nitrogen and phosphorous and assisting with their uptake.[14] Fungi are an essential component of soil and help to combat erosion and desertification.[15] They also provide biological regulation, meaning they serve a niche in the food web that helps it to properly function, both feeding and being fed on by other species.[16]

Fungi also provide food for both wildlife and humans, as well as medicinal and recreational drug effects that contribute to growing industries.[17] The science of mycology conservation and fungi's role in nature is still relatively nascent and much is still unknown.[18] Further developing this field by preemptively giving them legal protections and managing our forests accordingly could be essential to retaining the ecosystem services—particularly nutrient cycling, decomposition, regulation, and carbon storage—that these species provide.[19]

Fungal species are facing the same threats as plant and animal species, namely deforestation and development, pollution, overharvesting, and climate change.[20] Because many fungal species are connected to and dependent on trees and other

species for cultural use in Mesoamerican tribes).

10. Joëlle Dupont et al., *Fungi as a Source of Food*, 5 Microbiology Spectrum, Jun. 9, 2017, at 1–2.

11. Food and Agric. Org. of the United Nations, State of Knowledge of Soil Biodiversity - Status, Challenges and Potentialities 19–20 (2020).

12. *Id.*; Tina Dreisbach, *Importance of Fungi in Forest Ecosystems*, DecAID (Apr., 2002), [https://perma.cc/E97N-RZ8V].

13. Food and Agric. Org. of the United Nations, *supra* note 11 at 19–20.

14. *Id.* at 20.

15. *Id.*

16. *Id.*

17. Dreisbach, *supra* note 12. The U.S. psychedelic mushroom market size alone is valued at 1.8 million dollars and is expected to grow. *U.S. Psychedelic Mushroom Market Size, Share & Trends Analysis Report by Product (Psilocybe, Gymnopilus, Panaeolus), by Form (Fresh/Whole, Dried, Processed), by Application, and Segment Forecasts, 2025–2030,* Grand View Rsch., https://www.grandviewresearch.com/industry-analysis/us-psychedelic-mushroom-market-report [https://perma.cc/YY3P-48Z2] (last visited Apr. 23, 2024). This does not capture all the sales of cheese, bread, beer, wine, and mushroom produce sold in the United States.

18. May, *supra* note 3, at 733; Margulis & Chapman, *supra* note 2, at 381.

19. Food and Agric. Org. of the United Nations, *supra* note 11 at 21; Dreisbach, *supra* note 12.

20. Gibbens, *supra* note 4. *See generally* Nicola T. Case et al., *The Future of Fungi: Threats and Opportunities*, 12 G3, 1, 2–6 (2022) (explaining that warmer temperatures may also cause spreading of some fungal pathogens that threaten human health, crops, and other ecosystems).

plants, clear cutting, forest fires, and thinning create the same threats to fungal and plant species alike.[21] Additionally, changing temperatures can affect when, where, and how much fungi fruit and what hosts they attach to.[22]

While there has been little extensive study into the extinction status of the millions of fungal species, the International Union for the Conservation of Nature (IUCN) has created a working "Red List" of threatened species.[23] The IUCN is an environmental network that gathers international research results and makes policy recommendations to governments around the world.[24] They are a "neutral space" where international communities can refer to their research as a tool in their own lawmaking.[25] Their global Red List of Critically Endangered, Endangered, and Vulnerable Species currently includes 318 species in the fungi kingdom, under varying levels of concern.[26] Another 65 species are classified as Near Threatened.[27] They apply their criteria globally, but it can be adjusted to apply nationally and locally, potentially revealing a greater need for national protection of certain species.[28] The Red List is not itself a source of binding law on any country, though other countries have considered conservation of fungal species in their own laws according to the recommendations of the Red List.[29]

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), an international treaty that protects against international trade that could threaten species, has not listed any fungal species for international protection because they are neither "fauna" nor "flora."[30] As of yet, Chile is the only country that has independently protected a fungal species as endangered.[31]

Finally, fungi can also cause harm to humans through poisoning, infections, and diseases, ranging from mildly irritating to fatal. These harmful effects include but are not limited to athlete's foot, food poisoning, and asthma.[32] Although they

21. Dreisbach, *supra* note 12.

22. Boddy et al., *supra* note 4, at 24.

23. *Red List*, IUCN, https://www.iucnredlist.org/search?taxonomies=100001&searchType=species (last visited Apr. 23, 2024).

24. *About IUCN*, IUCN, https://www.iucn.org/about-iucn - overview (last visited Apr. 23, 2024) [https://perma.cc/9QMN-A2K6].

25. *Id.*

26. IUCN, *supra* note 24.

27. *Id.*

28. *See generally* Anders Dahlberg & Gregory M. Mueller, *Applying IUCN Red-Listing Criteria for Assessing and Reporting on the Conservation Status of Fungal Species*, 4 Fungal Ecology, 147, 148 (2011).

29. *See Fungal Conservation Tracker*, Fungi Foundation, https://fungalconservationtracker.ffungi.org/#all-countries (last visited Apr. 23, 2024) [https://perma.cc/6WXF-7P5W] (illustrating the Fungi Foundation tracks the extent to which different countries have integrated listed fungal species into legislation and planning).

30. Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendices I, II, and III, U.N. Environment Programme, Nov. 25, 2023, 3472 U.N.T.S. 14537.

31. Alejandra Olguín, *Butyriboletus Loyo: Surviving Extinction*, Fungi Foundation, https://www.ffungi.org/blog/butyriboletus-loyo-surviving-extinction (last visited Apr. 23, 2024) [https://perma.cc/H4HK-2ATE].

32. *See generally* Sachin N. Baxi et al., *Exposure and Health Effects of Fungi on Humans*,

may be harmful in some contexts, preserving them for further research could be the key to untapped medical potential and the maintenance of delicate ecosystems.[33] Any fungal pathogens that are known to be dangerous could simply be carved out of broader protections.[34] Additionally, any fungal species that would be affected by an approved fungicide under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) could additionally be carved out so as not to conflict with that Act.[35]

III. Federal Conservation of the Kingdom Fungi

Congress specifically anticipated medical contributions as a goal of preserving biodiversity when they enacted the ESA.[36] In the legislative history, they emphasized that the value of genetic variations is "incalculable" and that it is "in the best interests of mankind to minimize the losses" of such variation.[37] Congress also provided for the preservation of objects of scientific interest when enacting the Antiquities Act in 1906, which allows the President to establish National Monuments.[38] Additionally, Congress has also enabled federal land management agencies to protect and conserve their natural resources.[39] While these Acts do not specifically provide for the protection of fungal species, doing so would effectuate their underlying purposes because the fungi kingdom contains many diverse species of scientific curiosity and potential medical significance that are in dire need of protection.[40] Some vehicles of legal protection would further fungal biodiversity by protecting at-risk species while others would further conservation of their functions in their ecosystems.

A. The Endangered Species Act

The purpose of the ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species . . . "[41] This is a broad, ecosystem-centric goal that does not show intent to exclude certain kinds of species over others. The ESA could therefore conceivably

4 J. Allergy Clinical Immunology Prac., 1, 3 (2010) (The author is particularly irritated by *Malassezia*, which causes dandruff.)

33. *Gray Wolf Recovery News and Updates*, U.S. Fish & Wildlife Service, https://www.fws.gov/initiative/protecting-wildlife/gray-wolf-recovery-news-and-updates (last visited May 6, 2025) [https://perma.cc/RZ8K-NWG5] (Some species already protected under the ESA are also potentially deleterious to human health, such as wolves).

34. *See, e.g.*,Endangered Species Act 16 U.S.C. § 1532 (6) (carving out protections for the Class Insecta if determined to pose a risk to humans).

35. *See generally* Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. § 136.

36. *See Tennessee Valley Auth. v. Hill*, 437 U.S. 153, 178 (1978).

37. *Id.*

38. Antiquities Act of 1906, 54 U.S.C. §§ 320301–320303

39. *See* National Park Service Organic Act, 54 U.S.C. §§ 200101–200104; Fish and Wildlife Conservation Act, 16 U.S.C. §§ 2901–2912.

40. Endangered Species Act, 16 U.S.C. §§ 1531–1544 (describing the discovery and development of penicillin is a prime example of a fungal species contributing to medical research).

41. 16 U.S.C. § 1531 (b).

protect the biodiversity of fungal species in addition to plant and animal species. However, currently only three lichens are listed under the Act and there are potential roadblocks to the listing of other fungal species.[42]

The ESA provides for the listing of species as "threatened" or "endangered" under Section 4.[43] The Secretary of Interior, and through her the Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration (NOAA), which implement the Act, are responsible for making listing determinations.[44] In Section 3, the ESA defines a species as, "any subspecies of fish or wildlife or plants . . . " and defines a plant as, "any member of the *plant kingdom*, including seeds, roots and other parts thereof." (emphasis added).[45] Additionally, the ESA further protects only fish, wildlife, and plants in Section 9, which lists prohibitions regarding transport and "take" of the species.[46] This Section is similarly restricted to the species definition of "plant" in Section 3.

The fungi kingdom is independent from the plant kingdom and therefore it is potentially ambiguous if the Secretary of the Interior has the authority to list them under Section 4 or, if listed, protect them under Section 9. The definition of "plant" clearly references the taxonomic kingdoms that create the divide between plants and fungi and, one could argue, is unambiguous in its exclusion of fungal species because of this. The FWS has not clarified this issue through regulation; 50 CFR Section 424.02 defines "species" as "any species or subspecies of fish, wildlife, or plant, and any distinct population segment of any vertebrate species that interbreeds when mature."[47] This further supports the exclusion of fungi species.

However, at the time Congress passed the ESA in 1973 it was likely not yet widely accepted among biologists that fungi were a separate Kingdom; though biologist Robert Whittaker had proposed the idea in 1969, it wasn't included and copied in biology textbooks until 1979.[48] In multiple places throughout the legislative history of the ESA and its amendments, congressmen refer to fungi as a kind of plant and

42. *Listed Plants*, U.S. Fish & Wildlife Serv., https://ecos.fws.gov/ecp0/reports/ad-hoc-species-report?kingdom=P&status=E&status=T&status=EmE&status=EmT&status=EXPE&status=EXPN&status=SAE&status=SAT&mapstatus=3&fcrithab=on&fstatus=on&fspecrule=on&finvpop=on&fgroup=on&ffamily=on&header=Listed+Plants [https://perma.cc/UD2X-5ENX] (last visited Apr. 23, 2024). Lichens are a symbiotic partnership of both alga and fungus organisms, so the three lichens that are listed under the ESA aren't even fully fungal species. *About Lichens*, U.S. Forest Serv., https://www.fs.usda.gov/wildflowers/beauty/lichens/about.shtml#:~:text=Lichens%20are%20a%20complex%20life,shape%20to%20its%20fruiting%20bodies [https://perma.cc/FN2F-N9NU] (last visited Apr. 23, 2024). No fungal species, on its own, is listed under the ESA.

43. 16 U.S.C. § 1533.

44. *Id.* NOAA is relevant here because there are some aquatic species of fungi that they could list if jeopardized.

45. 16 U.S.C. §§ 1532 (14), (16).

46. 16 U.S.C. § 1538(a)(1).

47. 50 C.F.R. § 424.02 (2025). The definition also excludes insects that could constitute a pest.

48. Joel B. Hagen, *Five Kingdoms, More or Less: Robert Whittaker and the Broad Classification of Organisms*, 62 BioScience, 67, 71–72 (2012).

include them in discussions about what the Act could implicate. In the 1982 Act authorizing continuing appropriations, the Congressional Record references an article that uses the Penicillium fungus as an example of the great need to preemptively preserve species that may have yet unknown uses and value.[49] In the 1988 Act authorizing further continuing appropriations, the Congressional Record similarly references Penicillium, showcasing the potential of fungal species.[50]

Additionally, interest groups and outside parties contributed to the legislative history of the ESA through subcommittee hearings and often referred to fungal species as a kind of plant species. The Smithsonian's report classified fungi as a "lower plant group" and excluded them from their lists of studied species, at least for the time being.[51] Similarly, Michigan's Department of Natural Resources concluded that fungi were a lower form of plant to be initially excluded, and New York Botanical Garden's president also excluded fungi species due to being a plant that did not flower.[52] At the March 8, 1982 subcommittee hearing, Congressman Blair rejected the relegation of fungi to a lower plant status because it could result in an immensely useful fungal species like Penicillium going extinct.[53] Other groups such as the Nature Conservancy, Virginia Wildflower Preservation Society, and National Agricultural Chemicals Association contributed remarks emphasizing the potential and actual value of fungal species, supporting their conservation under the Act.[54] Therefore, to the extent that the enacting Congress was swayed by these remarks when legislating, they likely intended fungal species to be included in the Act's protections regardless of some regarding fungi as a separate taxonomic Kingdom at the time of legislation and further continuing appropriations.

As noted above, there are three listed lichens, and therefore, fungi species in the ESA.[55] Scholar Naveed Davoodian theorizes that these lichen species were listed due to their continued perception as plants and notes that relying on a misconception "will likely not facilitate listing for most fungi."[56] In 2014, the FWS and NOAA published

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49. 128 Cong. Rec. 13182 (1982) (statement of Sen. Chafee).

50. 134 Cong. Rec. 19273 (1988) (statement of Sen. Mitchell).

51. H.R. Doc. No. 94–51, at 18–19, 22 (1974).

52. *Endangered Species Act Oversight: Hearing Before the Subcomm. On Resource Protection of the Comm. on Env't. and Public Works*, 95th Cong. 425 (1978); Endangered Species Before the Subcomm. on Fisheries and Wildlife Conservation and the Env't. of the Comm. on Merchant Marine and Fisheries, 93rd Cong. 266 (1973).

53. *Endangered Species Act: Hearing Before the Subcomm. on Fisheries and Wildlife Conservation and the Env't. of the Comm. on Merchant Marine and Fisheries*, 97th Cong. 227 (1982).

54. *See Endangered Species Act Oversight: Hearing Before the Subcomm. on Env't Pollution of the Comm. on Env't and Public Works, 97th Cong. 519 (1981); Endangered Species Act: Hearing Before the Subcomm. On Fisheries and Wildlife Conservation and the Env't of the Comm. on Merchant Marine and Fisheries, 99th Cong. 291 (1985); Elephant Protection Act of 1979 and the International Wildlife Resources Conservation Act of 1980: Hearing Before the Subcomm. on Resource Protection of the Comm. on Env't and Public Works, 96th Cong. 87 (1980).*

55. U.S. Fish & Wildlife Serv., *supra* note 42.

56. Davoodian, *supra* note 9, at 2102.

a proposed regulation suggesting that future rulemaking could broaden ESA listing to non-plant or animal kingdom species:

> In 1973, only the Animal and Plant Kingdoms of life were universally recognized by science, and all living things were considered to be members of one of these kingdoms. Thus, at enactment, the ESA applied to all living things. Advances in taxonomy have subsequently split additional kingdoms from these two. Any species that was considered to be a member of the Animal or Plant Kingdoms in 1973 will continue to be treated as such for purposes of the administration of the Act regardless of any subsequent changes in taxonomy. We may address this issue in a future rulemaking relating to making listing determinations (as opposed to designating critical habitat). In the meantime, the republication of these definitions here should not be viewed as an agency determination that these definitions reflect the scope of the Act in light of our current understanding of taxonomy.[57]

Because at least one scientist conceptualized the fungi kingdom as separate from the plant kingdom as early as 1969, it is possible to argue that "any species that was considered to be a member of the Animal or Plant Kingdoms in 1973" would still exclude fungi.[58] However, given that it would not be regularly included as such in textbooks for another decade, the statement that the ESA applied to "all living things," and that the legislative history is littered with references to fungi as plants, this argument is weak. Nonetheless, this proposed rule did not become a final rule and no "future rulemaking" has been promulgated as suggested.

Looking forward, Congress could amend the ESA to clearly include fungi in the definition of "species," the FWS and NOAA could promulgate regulations interpreting fungi as a species under the Act, or the agencies could simply start listing fungal species and litigate any challenges, if need be, based on Congress' demonstrated intent to include them in the Act. Should fungal species be fully and regularly incorporated into the ESA, they will enjoy such protections as the Section 7 "consultation" requirement that requires federal agencies to consult with the FWS or NOAA if their project jeopardizes a listed species and the Section 9 "no-take" provisions, just like all other listed species. While the ESA has its critics, it could be an effective vehicle for preserving the biodiversity and genetic value of yeast, lichen, mold, and mushroom species.

B. Other Federal Land Management Agencies[59]

Federal land management agencies publish regulations to further the purposes for which they were created, including the conservation of natural resources. An

57. Listing Endangered and Threatened Species and Designating Critical Habitat; Implementing Changes to the Regulations for Designating Critical Habitat, 79 Fed. Reg. 27066 (proposed May 12, 2014) (to be codified at 50 C.F.R. pt. 424).

58. Hagen, *supra* note 48, at 71.

59. The Army Corps of Engineers is also a land management agency, as is the Tennessee Valley Authority. These agencies are primarily concerned with water reclamation and energy generation. Fed. Energy Regul. Comm'n, Hydropower Primer: A Handbook of Hydropower Basics 1 (2017). Because of this, I do not explore their potential to protect natural resources in general or fungi species in particular.

agency could therefore promulgate a rule that protects fungal species if it is within their statutorily delegated authority to do so. While these protections would contribute to fungal biodiversity, they would not concentrate only on at-risk species and could protect whole ecosystems, and the role fungal species play and services they provide within them.

1. Fish and Wildlife Service

In addition to facilitating the ESA, the FWS administers 590 National Wildlife Refuges (Refuges) throughout every state and territory.[60] In 1997, Congress created the modern National Wildlife Refuge System and provided that the FWS manage it for compatible uses such as fishing, hunting, wildlife observation, and environmental education.[61] The FWS promulgated 50 CFR Section 27.21, providing that "no person shall take any animal or plant on any national wildlife refuge, except as authorized under 50 CFR Section 27.51 and parts 31, 32, and 33. . . . "[62] Similar to the ESA, the FWS here defines "plant" as "any member of the *plant kingdom* in a wild, unconfined state, including any plant community, seed, root, or other part of a plant" (emphasis added).[63] This definition then runs the same risk as in the ESA of explicitly excluding fungi because they are a taxonomically separate Kingdom. Further, the FWS promulgated this definition in 2000, long after the acceptance of the taxonomic shift to a different Kingdom for fungi, so there is less evidence to support the intent to include them.

The exclusion continues in Section 27.51, which prohibits the "disturbing, injuring, spearing, poisoning, destroying collecting or attempting to disturb, injure, spear, poison, destroy or collect any plant or animal on any national wildlife refuge . . . except by special permit unless otherwise permitted under this subchapter. . . . "[64] This regulation is also subject to the definition of "plant" provided above. While the FWS manages Refuges for multiple recreational uses, it has prioritized protection of natural resources throughout these regulations. Failing to include fungal species in these protections could result in overharvesting or "take" of fungal organisms that are an integral part of their ecosystems. The FWS should promulgate regulations to add a definition for "fungi" and amend Section 27.21 and Section 27.51 to include them in their protections.

One other way the FWS could contribute to the protection of fungal species in National Wildlife Refuges is through the Comprehensive Conservation Plans (CCP). These are long-term planning documents that are created in conjunction with state agencies and local participants and are updated every fifteen years.[65] Each Refuge

60. *Locations, U.S. Fish and Wildlife Serv.*, https://www.fws.gov/locations?$orderby=title%20desc [https://perma.cc/4MCA-F5FT] (last visited Apr. 23, 2024).

61. National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. § 668dd, Pub. L. No. 105–57, § 2.6, 111 Stat. 1252, 1252.

62. 50 C.F.R. § 27.21 (2025).

63. 50 C.F.R. § 25.12 (2025).

64. 50 C.F.R. § 27.51 (2025). The "otherwise permitted" section refers to the provisions for hunting and fishing elsewhere in the chapter.

65. *Comprehensive Conservation Plans*, U.S. Fish and Wildlife Service, https://www.fws.

has its own CCP, as required by the National Wildlife Refuge System Improvement Act of 1997, which provides the goals and guidance for managing the Refuge.[66] Any CCP could include provisions for special management or conservation of fungal species that might be particularly at risk or of note in the Refuge. Because the FWS manages Refuges for multiple uses, it may not be appropriate to extensively protect all fungal organisms within their jurisdiction but including them in the planning process would provide valuable information about an invaluable natural resource.

2. National Park Service

In 1916, Wilson Woodrow signed the National Park Service Organic Act into law, creating the National Park Service (NPS) so that it shall "promote and regulate the use of the [National Park System] which purpose is to conserve the scenery, natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."[67] The NPS manages many different kinds of Park units with a focus on conservation of natural resources, including National Monuments created under the Antiquities Act by the President, as well as National Parks which are created individually by Congress.[68] The types of activities allowed in a Park and its management goals depend on the kind of Park Congress creates; for example, when creating a National Preserve, it is common for Congress to provide for hunting or fishing in the enabling legislation.[69] Alternatively, in a flagship National Park, Congress does not allow these recreational uses in the enabling legislation. If there were a certain resource Congress felt most inclined to protect, they could write it or amend it into the enabling legislation, which would supersede any subsequent regulations or park management decisions. The President could similarly include such conservation provisions in a Proclamation to create a National Monument. This is one way that fungi could be protected in National Park units.

The NPS regulations provide general rules applicable to all units in 36 CFR.[70] Section 2.1(a)(1) protects natural, cultural, and archeological resources including "[l]iving or dead wildlife or fish, or the parts or products thereof, such as antlers and nests," "plants or the parts or products thereof," "nonfossilized and fossilized paleontological specimens, cultural or archeological resources, or the parts thereof," and "a

gov/library/collections/comprehensive-conservation-plans (last visited Apr. 23, 2024). [https://perma.cc/7XDB-KRRD].

66. *Id.*

67. 54 U.S.C. § 100101(a) (2025).

68. I include this discussion of National Monuments under the National Park Service heading because the vast majority of Monuments are run by the NPS, but some National Monuments are managed by other land management agencies.

69. As an example of enabling legislation that allows for these kinds of recreational uses, Big Thicket National Preserve in Texas must permit hunting, fishing, and trapping on lands and waters within the preserve except where the Secretary of Interior designates otherwise after consulting with the State agency in charge of such activities. *See* 16 U.S.C. § 698c(c) (2025).

70. 36 C.F.R. § 1.1 (2025).

mineral resource or cave formation or the parts thereof."[71] Section 1.4 provides definitions, but fails to define the word "plant."[72] Therefore, because fungi are not plants, they are not facially included in this provision, but they are also not taxonomically excluded, as was the case in the ESA and National Refuge definitions of "plant."[73]

A notable exception to Section 2.1 is codified in Section 2.6, which allows gathering of "plant or plant parts" by enrolled members of federally recognized Indian tribes once they have received permission from the Park superintendent to harvest for traditional purposes within certain amounts of certain plants in certain places by certain methods.[74] The decision to allow harvesting is subject to the National Environmental Policy Act (NEPA) and must have "no significant adverse impact" on the Park resources or values.[75] "Plant or plant parts" is defined as vascular plants and their parts only and would therefore exclude any allowances to harvest fungi as fungi are not plants, let alone vascular ones.[76] This exclusion of fungi from the regulation ultimately might protect them, as they are not included in this foraging carve-out for tribes only, but at the cost of further alienating indigenous tribes from their ancestral lands and setting barriers to access for them.

Section 2.1(c)(1) allows the Park superintendent to designate "certain fruits, berries, nuts, or unoccupied seashells which may be gathered by hand for personal use or consumption upon a written determination that the gathering or consumption will not adversely affect park wildlife, the reproductive potential of a plant species, or will otherwise adversely affect park resources."[77] Under Section 2.1(c)(3), it is prohibited to gather or possess "undesignated natural products."[78] However, "natural products" is also undefined by Section 1.4.[79] Arguably, a "natural product" is simply shorthand for the list of items in Section 2.1(c)(1) i.e. fruits, berries, nuts, and occupied seashells, and should not be expanded past that list. However, this term could encompass a broader range of any natural product, including fungi. Therefore, if a Park superintendent fails to give provisions for fungi, they could be an "undesignated natural product" and collection of them would therefore be prohibited under Section 2.1(c)(3), despite being left out of the resources protected in Section 2.1(a). Of all sixty-three flagship National Parks, Cuyahoga Valley is the only Park that has interpreted these sections to mean that because fungi are not fruits, berries, nuts, or seashells, nor are they plants, the superintendent does not have the authority to provide for their harvesting. The Park has, therefore, banned the collection of any fungi.[80]

71. 36 C.F.R. § 2.1(a)(1) (2025).

72. 36 C.F.R. § 1.4 (2025).

73. Special thanks to John "Jay" Calhoun, the Chief of the Regulation, Jurisdiction, and Special Park Uses division of the NPS who brought this to my attention.

74. 36 C.F.R. § 2.1(d), § 2.6 (2025).

75. 36 C.F.R. § 2.6(d)(2) (2025).

76. 36 C.F.R. § 2.6 (a) (2025).

77. 36 C.F.R. § 2.1(c)(1) (2025).

78. 36 C.F.R. § 2.1(c)(3) (2025).

79. 36 C.F.R. § 1.4 (2025).

80. Cuyahoga Valley National Park, Superintendent's Compendium (2023). Acadia

36 CFR Section 13.35 specifically regulates Park units in Alaska and provides separate rules for preservation of natural resources.[81] The section applies to all Park sites in Alaska (except four) and prohibits gathering or collecting of "natural products."[82] It goes on to define "natural products" for the purposes of just this section as "living or dead fish and wildlife or parts or products thereof, plants or parts or products thereof, live or dead wood, *fungi*, seashells, rocks, and minerals" (emphasis added).[83] In the next section, it allows gathering by hand for personal use of natural plant food items including mushrooms so long as they are not threatened or endangered species.[84] The superintendents can impose further restrictions on size and quantity of the resources under certain conditions.[85] This is the only federal land management regulation that explicitly includes fungi as a protected natural resource, and thus supports the idea that they could be included elsewhere.

Each year, the superintendent of each Park unit issues (or should issue) a Superintendent's Compendium which provides Park-specific regulations as an extension of the CFR. These Compendiums harbor specific management practices such as limits on foraging, as discussed above. I surveyed the sixty-three flagship National Park's Compendiums to assess which ones provided for harvesting mushrooms and fungi, and under what conditions one can harvest.[86] Four Parks prohibited mushroom collecting entirely. Twenty-two Parks gave specific rules about how, what amount, and at what rate one could collect mushrooms. These rules varied by quantity, how often one could harvest, what kinds of mushrooms were approved, what parts of the mushrooms could be harvested, and where one had to consume them. Under Section 2.1(c)(2), the superintendent may place such restrictions on harvesting.[87] Thirty-six Parks did not give any guidance as to fungal harvesting, so this could either mean any fungi are available for unrestricted harvest since they are not included in Section 2.1(a), or it could mean it is prohibited to harvest them as they are an "undesignated natural product" under Section 2.1(c) or alternatively prohibited under Cuyahoga Valley's reasoning. Harvesting the fruiting bodies of mushrooms can be a sustainable

National Park makes a somewhat similar determination in prohibiting fungal harvesting on the basis of them not being a "fruit" despite having a "fruiting body," but does not speak to whether they're *authorized* to allow for it. Acadia National Park, Superintendent's Compendium (2023).

81. 36 C.F.R. § 13.35 (2025).

82. 36 C.F.R. § 13.35 (a), (b) (2025). The four excluded parks are Klondike Gold Rush National Historical Park, Sitka National Historical Park, Denali National Park, and Katmai National Park.

83. 36 C.F.R. § 13.35(b) (2025).

84. 36 C.F.R. § 13.35(c) (2025).

85. 36 C.F.R. § 13.35(f) (2025).

86. The Appendix includes a breakdown of the restrictions for each Park. There are 429 units of the NPS, all with their own Superintendent Compendiums that may or may not provide for fungal harvesting. I decided to survey the flagship Parks because they consistently have the most undeveloped areas where fungi may contribute to ecosystems, and they also have the most consistently protective enabling legislations that would lead to a higher likelihood of specific protection of natural resources.

87. 36 C.F.R. § 2.1(c)(2) (2025).

management practice, but it is important that these activities are regulated, so as to preserve their essential contributions to the ecosystem.

The NPS could promulgate a rule that adds fungi to the lists in Section 2.1(a) or 2.1(c), or they could choose to include fungi in the definition of "natural product" or "plant" (even though that would not be taxonomically accurate). Any of these options would create clearer guidance for Park managers and visitors and provide stronger protections for fungi within National Park Units by setting more restrictive default rules against harvesting.

3. United States Forest Service

With the Forest Service Administration Act of 1897, Congress created the United States Forest Service (USFS) to improve and protect the forests they manage, to conserve the flow of water, and to sell timber.[88] Congress further designated National Forests to be administered for uses such as outdoor recreation, range, timber, watershed, and wildlife and fish purposes.[89] The Secretary of Agriculture develops and administers "the renewable surface resources of national forests for multiple use and sustained yield of the several products and services obtained therefrom."[90] Therefore, the USFS does not prioritize the wholesale conservation of natural resources over other uses and has not promulgated regulations equivalent to the FWS and NPS protections discussed above.

However, it is the policy of the U.S. Department of Agriculture to direct the USFS to conduct activities and programs "to assist in the identification and recovery of threatened and endangered plant and animal species," and to avoid actions "which may cause a species to become threatened or endangered."[91] Some policies specify that the focus is on plant, fish, and wildlife species while others generally provide for "species."[92] In keeping with the ESA, the USFS must "develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions."[93] This has led to the Threatened, Endangered, and Sensitive Species (TES) regional programs that include initiatives to achieve recovery and conservation goals.[94] Each USFS region identifies their own lists of sensitive species that occur in their forests and create their own management strategies so as

88. Forest Service Organic Administration Act of 1897, 16 U.S.C. §§ 473–482 (2025).

89. 16 U.S.C. § 528 (2025).

90. 16 U.S.C. § 529 (2025).

91. Forest Serv., U.S. Dep't of Agric., Amend. No. 2600–2005–1, Forest Service Manual 2600 – Wildlife, Fish, and Sensitive Plant Habitat Management: Chapter 2670 – Threatened, Endangered and Sensitive Plants and Animals 3–4 (2005); *see also* U.S. Dep't of Agric., Departmental Regul. No. 9500–004, Fish and Wildlife Policy (2008).

92. Forest Serv., U.S. Dep't of Agric., *supra* note 91.

93. *Id.* at 4. Because these policies are tied to the ESA, they may share the same weaknesses of fungal protection that the ESA does, discussed above.

94. *Threatened, Endangered & Sensitive Species*, U.S. Dep't of Agric., https://www.fs.usda.gov/managing-land/natural-resources/threatened-endangered-species (last visited Apr. 23, 2024) [https://perma.cc/C38G-APX3].

to avoid threatening these species.[95] Some Regions have defined "sensitive species" as only plants and animals that are at-risk, and no lists or plans have included fungi species as part of this program.[96] In the future, forest regions could evaluate whether there are fungi species at risk in their forests and include them in these "sensitive species" lists, programs, and management strategies, since the policies underlying these programs provide for the protection of species generally.

Another vehicle for the Forest Service to protect natural resources is through regional Forest Plans. The Bureau of Land Management (BLM) and the USFS co-manage The Survey and Manage Standards and Guidelines (SMP) of the Northwest Forest Plan (the Plan), which they created in 1994 to protect "rare and little known species thought to be associated with late-successional and old growth forests" in the Northwest area.[97] The SMP include protections for hundreds of species such as mosses, slugs, voles, salamanders, lichens, and fungi, among others.[98] It was an "unprecedented conservation action" for fungal species and incorporated extensive consultation with mycologist experts to determine which species to include.[99] The original SMP protected 234 fungi species across four categories of various protections, but over time removed 39 species after discovering they were not as rare as first believed, or taxonomically duplicative.[100] These protections came in the form of managing known sites to mitigate impact and doing further research and surveys to find more sites.[101]

The agencies restructured the Plan and its SMP provisions in 2001, removing some species, revising for clarity, providing for ongoing species review, and creating two new categories "to better align species groups with management objectives," among other modifications.[102] Both the 1994 and 2001 Plans were controversial among environmentalists who sought greater protections and loggers in the Pacific Northwest who sought the profits that the Plan was preventing.[103] In 2004, the agencies removed the SMP provisions from the Plan and environmentalist groups sued.[104]

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95. *Id.*

96. *Id.; Interagency Special Status / Sensitive Species Program*, Bureau of Land Mgmt. & U.S. Forest Serv., https://www.fs.usda.gov/r6/issssp/policy/ (last visited Apr. 23, 2024) [https://perma.cc/T2N3-PDNQ].

97. *Northwest Forest Plan: Survey and Manage: History*, U.S. Forest Serv., Reg'l Ecosystem Off., https://www.fs.usda.gov/r6/reo/survey-and-manage/history.php (last visited Apr. 23, 2024) [https://perma.cc/H7HQ-25UZ]. This area includes the federal lands within the coastal areas of northern California, Washington, and Oregon.

98. *Id.*

99. Randy Molina, *Protecting Rare, Little Known, Old-Growth Forest-Associated Fungi in the Pacific Northwest USA: A Case Study in Fungal Conservation*, 112 Mycological Research 613, 634 (2008).

100. *Id.* at 616, 628–29.

101. *Id.* at 629.

102. Bureau Land Mgmt. & U.S. Forest Serv., Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures 6–7 (2001).

103. Molina, *supra* note 99, at 614–15.

104. *Nw. Ecosystem All. v. Rey*, 380 F. Supp. 2d 1175 (W.D. Wash. 2005).

The district court struck the 2004 elimination of the SMP due to failure to comply with NEPA and reinstated the 2001 Plan, but later allowed four project exceptions to the SMP.[105] These "Pechman exceptions" consist of thinning projects in stands younger than 80 years old, replacement and removal of culverts on road systems, riparian and stream improvement projects under certain conditions, and projects with hazardous fuel treatments as a part of prescribed fires.[106]

In 2007, the agencies once again attempted to remove the SMP from the Plan but were met with more litigation by environmental organizations.[107] A district court again found that the agencies violated NEPA.[108] The parties then settled, forming a consent decree which the district court approved, but that the Ninth Circuit then overturned and remanded due to conflict "with laws governing the processes for such amendments" to the SMP.[109] On remand, the district court vacated the 2007 rule eliminating the SMP and returned to prior conditions, though the court allowed projects that had already been started in reliance on the consent decree to continue.[110] Therefore, the current state of the SMP and the Plan is as they were when issued in 2001, subject to the "Pechman exceptions." Forest Service Regions 5 and 6 still implement the SMP and it is still a valuable tool for protecting hundreds of fungi species in the Pacific Northwest.[111] However, these protections cover relatively little of the country and are thus limited in scope. Furthermore, this rocky history of litigation does not inspire confidence in the longevity of these protections, and future threats to these protections could be looming.

Optimism may be in order though, as the USFS recently proposed a rule that aims to amend the Plan to improve fire resistance, adapt to and mitigate the effects of climate change, maintain and expand old growth forest conditions, incorporate Indigenous knowledge, and support sustainability of local communities.[112] This is part of a larger movement to amend all 128 forest land management plans to "provide consistent direction to conserve and steward old-growth forest conditions in response to rapidly changing climate conditions."[113] The proposed amendments don't seem to

105. *Id.* at 1197–98; Stipulation and [Proposed] Order Re: Injunction, Nw. Ecosystem All. v. Rey, 380 F. Supp. 2d 1175 (W.D. Wash. Oct. 11, 2006) (No. 04–844) (Bloomberg Law).

106. Stipulation and [Proposed] Order, *supra* note 105. These are called the "Pechman exceptions" after the Judge who ordered them.

107. *Conservation Nw. v. Rey*, 674 F. Supp. 2d 1232 (W.D. Wash. 2009).

108. *Id.* at 1246.

109. *Conservation Nw. v. Rey*, No. C08–1067-JCC, 2011 WL 13193275 (W.D. Wash. July 6, 2011); *Conservation Nw. v. Sherman*, 715 F.3d 1181, 1189 (9th Cir. 2013).

110. *Conservation Nw. v. Bonnie*, No. C08–1067-JCC, 2014 WL 12710341, at *4–5 (W.D. Wash. Feb. 18, 2014).

111. *See Regional Ecosystem Office (REO) – Northwest Forest Plan Survey and Manage*, U.S. Forest Serv., *https://www.fs.usda.gov/r6/reo/survey-and-manage/* (last visited Apr. 23, 2024) [*https://perma.cc/5KES-CEC3*].

112. Region 5 and Region 6; California, Oregon, and Washington; Forest Plan Amendment for Planning and Management of Northwest Forests Within the Range of the Northern Spotted Owl, 88 Fed. Reg. 87393 (proposed Dec. 18, 2023).

113. *National Old-Growth Amendment*, U.S. Forest Serv.., https://www.fs.usda.gov/managing-land/old-growth-forests/amendment#:~:text=On%20December%2019%2C%202023%2C%20

alter the SMP provisions. This rule's comment period closed in January of 2024 and the USFS expected a final rule in October of 2024.[114] However, the final rule did not publish, and the Trump administration withdrew the rule in 2025.[115]

Finally, as multiple-use managers of the land, each individual Forest can create their own policies regarding mushroom harvesting. Some forests require permits and fees to forage a certain amount of mushrooms under certain conditions; for example, the Malheur, Umatilla, and Wallowa-Whitman National Forests (Blue Mountains Forests) require a $20 permit and $2 per day fee to pick mushrooms for commercial use for ten consecutive days.[116] There is no permit necessary for an "incidental amount" defined as one gallon or less in Oregon and five gallons or less in Washington.[117] Furthermore, commercial harvesting is prohibited in wilderness areas or other areas, as designated.[118] This permit system does not require sustainable foraging, such as only cutting off the fruiting body, and therefore does not provide for the conservation of underground reproductive mycelium, nor does it set any upper limit on harvesting. Forests should therefore implement plans for mushroom foraging that regulate the method and quantity of harvesting, so as to better ensure sustainable practices.

4. Bureau of Land Management

Congress set the BLM's current mission through the Federal Lands Policy and Management Act (FLPMA) of 1976.[119] Like the Forest Service, it is an agency that manages on the basis of multiple use and sustained yield.[120] However, the BLM recently published a final Public Lands Rule that "recognizes conservation as an essential component of public lands management, on equal footing with other multiple uses of these lands."[121] This rule shifts BLM policy to manage for landscape health, restore and protect public lands through restoration and mitigation leases, and better designate and manage Areas of Critical Environmental Concern (ACECs).[122] At time of writing, it has not yet been published in the Federal Register, and during the comment period it drew over two hundred thousand comments.[123]

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the,to%20rapidly%20changing%20climate%20conditions., (last visited Apr. 23, 2024).

114. *Id.*

115. *Id.*

116. U.S. Forest Serv., 2023 Mushroom Guide: Malheur/Umatilla/Wallowa-Whitman National Forests 1 (2023).

117. *Id.*

118. *Id.*

119. Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701–1785 (2018).

120. 43 U.S.C. § 1701(a)(7).

121. *Public Lands Rule*, Bureau of Land Mgmt., https://www.blm.gov/public-lands-rule (last visited Apr. 23, 2024) [https://perma.cc/852L-7ZCL].

122. *Biden-Harris Administration Finalized Strategy to Guide Balanced Management, Conservation of Public Lands*, Bureau of Land Mgmt., https://www.blm.gov/press-release/biden-harris-administration-finalizes-strategy-guide-balanced-management-conservation (April 18, 2024) [https://perma.cc/SLN2-CV9V]. At time of writing, the final rule has not yet been published in the Federal Register.

123. *Id.*

This rule clarifies how the BLM considers new nominations for ACECs and will prioritize their designation and protection.[124] ACECs are areas where special management protects "important natural, historic, cultural and scenic resources, systems or processes . . . " and FLPMA requires their development.[125] The activities and uses allowed in each ACEC depend on the resources found in that area during the planning stage.[126] Therefore, in the future, the BLM could use these stronger ACEC provisions to manage for conservation of natural resources, including fungi species and their ecosystems.

Additionally, similar to the USFS, the BLM sets policy to designate and conserve "sensitive species" so as to avoid their listing under the ESA.[127] Implementation of this policy includes monitoring populations and habitats of these species, developing ecosystem-based conservation strategies, and considering the ecosystem and native biodiversity so as to reduce further management as a sensitive species.[128] Although these policies discuss conservation and monitoring of these species holistically and do not list plant, fish, or wildlife categories, the glossary defines "species" as "any species or subspecies (and regarding plants, any varieties), and any distinct population segment or evolutionarily significant unit of any species of vertebrate, fish, or wildlife that interbreeds when mature."[129] Also, these policies are meant to act as a prophylactic to ESA regulation and discuss plants, wildlife, and fish in reference to the ESA and its provisions and elsewhere. Thus, one could argue it is implied that this carries over into the BLM's implementation and therefore does not cover species in the fungi kingdom.[130] The BLM could amend these policies to include fungi species in their implementation of the "sensitive species" provisions.

Finally, from 1994 to 2016, the BLM co-managed and participated in the SMP of the Northwest Forest Plan discussed above. BLM land comprised ten percent of the land covered by the Plan.[131] In 2016, BLM issued new Resource Management Plans for northwestern and southwestern Oregon, eschewing the SMP provisions of the Northwest Forest Plan.[132] They reasoned that the SMP came from Forest Service

124. *Id.*

125. *Interior Department Releases Proposed Plan to Guide the Balanced Management of Public Lands*, U.S. Dep't of the Interior, https://www.doi.gov/pressreleases/interior-department-releases-proposed-plan-guide-balanced-management-public-lands (Apr. 4, 2023) [https://perma.cc/5GMK-QQG4]; 43 U.S.C. § 1701(11).

126. *Areas of Critical Environmental Concern*, Bureau of Land Mgmt., https://www.blm.gov/programs/planning-and-nepa/planning-101/special-planning-designations/acec-s (last visited Apr. 23, 2024) [https://perma.cc/9AV9-USPY].

127. U.S. Dep't of the Interior, 6840 - Special Status Species Management 36 (2008).

128. *Id.* at 37–38.

129. *Id.* at 47.

130. *Id.*

131. *Old-Growth Forest Management in the Pacific Northwest Region Oversight: Hearing Before the Subcomm. on Pub. Lands and Forests of the Comm. on Energy and Nat. Res.*, 110th Cong. (2008) (statement of James Caswell, Director, Bureau of Land Management).

132. Bureau of Land Mgmt., Southwestern Oregon Record of Decision and Approved Resource Management Plan, 27–28 (2016); Bureau of Land Mgmt., Northwestern Oregon Record of Decision and Approved Resource Management Plan, 28 (2016).

laws and therefore did not apply.[133] They also noted that the species protected by the SMP would now be protected under the "sensitive species" policies instead.[134] This could have been an adequate alternative for fungi species if any fungi species were protected under those provisions, but because they were not, the same problem of their taxonomic exclusion arises.

IV. State Conservation of the Kingdom Fungi

The major ESA protections consist of a "consultation" requirement that only applies to federal agency actions and a "no-take" provision that can apply to both public and private lands.[135] However, in regard to plants, the "no-take" provision only applies to species in federal jurisdiction, and not private or state-owned lands.[136] States can then step in to fill gaps as more than ninety percent of species already listed have habitats on nonfederal lands.[137]

The ESA provides for and funds cooperation with states through "cooperative agreements" that create programs to conserve endangered and threatened species, subject to agency approval.[138] Additionally, states can enact their own endangered species statutes that are more restrictive than the ESA.[139] For example, California has its own Endangered Species Act (CESA) that provides for the listing and protection of species.[140] CESA has similar definitions as the ESA: § 2602 of the Fish and Game Code defines an endangered species as "a native species or subspecies of bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease.[141] This definition could similarly exclude fungi because of their taxonomic independence from plants. Therefore, state actions may run into the same limitations as the ESA when

133. Southwestern Oregon Record of Decision and Approved Resource Management Plan, *supra* note 132, at 27; Northwestern Oregon Record of Decision and Approved Resource Management Plan, *supra* note 132 (2016).

134. Southwestern Oregon Record of Decision and Approved Resource Management Plan, *supra* note 132; Northwestern Oregon Record of Decision and Approved Resource Management Plan, *supra* note 132 (2016).

135. 16 U.S.C. §§ 1536, 1538.

136. 16 U.S.C. § 1538(a)(2)(B).

137. Jean O. Melious, *Enforcing the Endangered Species Act Against the States*, 25 Wm & Mary Env't L. & Pol'y Rev.605, 605 n. 6 (2001).

138. 16 U.S.C. § 1535(c)-(d).

139. 16 U.S.C. § 1535(f).

140. CESA enacted protection for endangered species in 1970, three years before the federal ESA, but must nonetheless comply with its cooperation provisions so as not to be pre-empted due to the Supremacy Clause of the U.S. Constitution. *California Endangered Species Act*, Water Educ. Found., https://www.watereducation.org/aquapedia/california-endangered-species-act#:~:text=California%20was%20the%20first%20state,the%20federal%20Endangered%20Species%20Act (last visited Apr. 23, 2024) [https://perma.cc/HU6Y-WN64].

141. *Compare CESA to the Federal Endangered Species Act*, Cal. Dep't of Fish and Wildlife, https://wildlife.ca.gov/Conservation/CESA/FESA (last visited Apr. 23, 2024) [https://perma.cc/Q3VK-87FW]; Cal. Fish & Game Code § 2062 (West).

striving to protect threatened or endangered fungi species to conserve their biodiversity. However, because states may enact *more* restrictive laws, there is no obstacle to states including fungi species on their own lists.[142] States and their natural resource agencies could tailor the statutes and regulations to prioritize conservation and protection of the fungal species that are most at risk in their jurisdictions.

Forty-six states have enacted endangered species laws, which vary in provisions for listing, designating critical habitat, prohibitions, requiring permits, participating in conservation agreements, enforcement, agency consultation, and species recovery plans.[143] New York recently passed bill A. 4077, which keeps federally protected species on the state list for conservation, even after they leave the federal list.[144] Because there are no federally listed fungal species, provisions like this do nothing to further fungi conservation. As of 2020, at least 22 states were considering new legislation related to endangered species.[145] Where fungi conservation could fit in each state's laws will vary depending on what current policies and laws are in place, but this gives states flexibility to prioritize the species and ecosystems that need the most protection. Unfortunately, the possibility of future ad hoc state protections for fungal species is contingent on each state's willingness to take up this issue and could result in inconsistent protections, if any.

Additionally, The Natural Resources Conservation Service (NRCS) is a non-regulatory agency under the Department of Agriculture that assists in resource conservation on local private lands in every state.[146] The NRCS's conservation measures do not specifically focus on at-risk species and include financial and technical assistance for agricultural and private landowners.[147] They could include research and planning regarding fungi species when providing support in their programs. Finally, states and local county and city governments could also impose rules and regulations on fungi impact and harvesting within lands and parks that they manage. For example, Cleveland Metroparks in Ohio forbids any mushroom collecting.[148]

V. Recommendations

The following is a summary of the opportunities available in the current legal landscape to protect species within the fungi kingdom. First, regarding the ESA,

142. There may still be political obstacles, or other environmental laws that would apply to any state action, such as the California Environmental Quality Act. Susan George & William J. Snape III, *State Endangered Species Acts, in* Endangered Species Act Law, Policy, and Perspectives 345, 348 (Donald C. Baur & WM. Robert Irvin eds., 2d ed. 2010); 16 U.S.C. § 1535(f).

143. *See generally id.* (for example, North Carolina requires concurrence of several committees when deciding to list, whereas Montana reserves listing for the legislature).

144. Assemb. 4077A, 2019–2020 Legis. Sess., Reg. Sess. (N.Y. 2020).

145. *See 2020 Endangered Species Bills*, NCEL, https://www.quorum.us/spreadsheet/external/BEvuEVNQPGccHItKgSaP/ (last visited Apr. 23, 2024) [https://perma.cc/H4EF-K2PW].

146. *About NRCS*, Nat. Res. Conservation Serv., https://www.nrcs.usda.gov/about (last visited Apr. 16, 2025).

147. *Alabama*, Natural Resources Conservation Serv., https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/alabama (last visited Apr. 23, 2024).

148. Cuyahoga Valley National Park, *supra* note 80.

second, regarding federal land management agency regulations, and third, regarding state and local actions.

First, at the time Congress passed the ESA, biologists had not yet widely recognized the fungi kingdom as taxonomically separate. It is now so recognized. Therefore, FWS and NOAA should update their regulations at 50 CFR Section 434.02 to accommodate the protection of fungal species by changing the definitions of "species" to include fungi. They anticipated this in 2014 with a proposed regulation that suggested further clarification of taxonomy, but have not yet done so.[149] Alternatively, Congress could amend the ESA itself to include fungi species within its "species" definition in Section 3 and within the "no-take" provision of Section 9. Either way, the agencies could then safely and unambiguously research and consider listings for threatened or endangered fungi species. The agencies could also simply start listing fungi species without any legal changes and, if challenged on the basis of taxonomical exclusion, could argue that there was Congressional intent to include fungi species in the ESA due to support in the legislative history and prevailing knowledge about taxonomy at the time.

Second, federal land management agencies such as the FWS, NPS, USFS, and BLM can also adapt to include protection of fungi. The FWS should include fungi in the prohibitions regarding National Wildlife Refuges, 50 CFR Section 27.21 and Section 27.51, by amending them to taxonomic-neutral or fungi-inclusive language and definitions. As CCPs become re-issued, they should also focus on including fungi in those planning documents for each Refuge.

The NPS should amend 36 CFR Section 2.1(a)(1) by adding fungi to the list of resources that cannot be disturbed so as to set an unambiguous default of non-harvesting or destruction within NPS lands, similar to the language in 36 CFR Section 13.35. Each individual park superintendent could alternatively ban or limit fungi harvesting in the Park Compendiums, as some Parks have already done, so as to ensure sustainable fungi populations. Congress and the President could also amend or enact enabling legislation or proclamations to specifically provide for protections of certain fungi species.

The USFS Regions and the BLM should include fungi species in their lists and programs for sensitive species and manage accordingly to protect them. They should also modify any policy language that is not taxonomically inclusive of fungi. Additionally, more USFS Regions could follow the example of Regions 5 and 6 by enacting a Forest Plan that plans and protects fungi species, and the BLM could re-join the Northwest Forest Plan's SMPs or create new plans of their own to provide for protection of fungi species. The BLM could also focus on needed protections for fungi species in their ecosystems in ACECs as they make the monumental step to move ahead with conservation planning pursuant to their new rule.

Third, states legislatures and agencies that administer their own endangered species laws could enact more protective legislation and policies for fungi species, and

149. Implementing Changes to the Regulations for Designating Critical Habitat, *supra* note 57.

to the extent that they have taxonomically exclusive language, they could amend the definitions and provisions to include the fungi kingdom. State agencies, counties, and cities could also adopt land management policies to protect ecosystems holistically, so as to protect the fungi species and their essential processes that are not yet at risk.

As a final consideration, it is also essential that current protections for plants and animals remain in place as robust natural resource protection statutes and regulations may collaterally protect fungi if they are in the same habitats as other species. For example, the ESA requires agencies to designate critical habitat for listed species so as to define where protections are necessary.[150] To the extent that fungi share the designated habitat, they would share in those same protections. Similarly, the NPS regulations give the impression of broad protections for all natural resources, even if fungi are not explicitly included, leading to admonitions not to take *anything* from a National Park even if the statement is not specific to fungi.[151] Even the Wilderness Act of 1964, which prohibits roads and other developments or intrusions, can and does protect fungal species as a result of protecting the ecosystem holistically.[152] However, development of natural areas continues and can threaten fungal species if they are not explicitly protected through other means. Because of this, fungi should be specifically included in statutes and regulations at both the federal and state levels when appropriate for protecting biodiversity or ecosystem needs.

VI. Conclusion

There are over a million species of fungi that already contribute to medicinal, recreational, and agricultural uses, and that perform essential ecosystem services and inhabit irreplaceable niches in their ecosystems. More is yet unknown about the potential uses and values of fungi species and their contributions. Yet, because the laws and policies of land management agencies and states have largely not kept up with taxonomic definitions that separate the plant kingdom from the fungi kingdom, fungi have uncertain fates regarding the protection these statutes, regulations, and policies offer. The FWS has anticipated future rulemaking to include species outside of the plant and animal kingdoms in the ESA but has thus far neglected to do so. Additionally, federal land management agencies have created some protections for fungi species in certain limited areas but have not holistically protected fungal species within their regulations and policies. Finally, states and local governments have largely not filled in the gaps for fungal species that are left by federal conservation schemes. This leaves a great opportunity for legislatures, agencies, and states to prioritize the precautionary measures needed to protect fungi, whether for the biodiversity encoded within their genomes, or the ecosystem services they provide.

150. 16 U.S.C. § 1533.

151. For example, the Channel Islands says "[e]verything is protected" on their "Laws & Policies" website. *Laws & Policies*, Channel Islands Nat'l Park, https://www.nps.gov/chis/learn/management/lawsandpolicies.htm (last visited Apr. 23, 2024) [https://perma.cc/RM5A-7M3U].

152. *See generally* Wilderness Act of 1964 16 U.S.C. §§ 1131–1136. This is evident in forest policies that prohibit commercial harvesting of fungi in Wilderness areas. Forest Service, U.S. Dep't of Agric. , *supra* note 91.

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Acadia NP	No collecting allowed		Too little is presently known about mushroom ecology and the impact of mushrooms harvesting on the wider ecosystem to permit such activity. In addition, mushrooms are "fruiting bodies" and so cannot be considered "fruit."	https://www.nps.gov/acad/learn/management/sc.htm
NP of American Samoa	No Rule			https://www.nps.gov/npsa/learn/management/upload/NPSA_Compendium_03–03–2023–2.pdf
Arches NP	No Rule			https://www.nps.gov/arch/learn/management/compendium.htm
Badlands NP	No Rule			https://www.nps.gov/badl/learn/management/superintendent-s-compendium.htm
Big Bend NP	No Rule			https://www.nps.gov/bibe/learn/management/upload/2023-Big-Bend-Supt-Compendium-web.docx
Biscayne NP	No Rule			https://www.nps.gov/bisc/learn/management/superintendents-compendium.htm
Black Canyon of the Gunnison NP	No Rule			https://www.nps.gov/blca/learn/management/superintendents-compendium.htm
Bryce Canyon NP	No Rule			https://www.nps.gov/brca/learn/management/superintendents-compendium.htm
Canyonlands NP	No Rule			https://www.nps.gov/cany/learn/management/compendium.htm
Capitol Reef NP	No Rule			https://www.nps.gov/care/learn/management/upload/Compendium-2023.pdf
Carlsbad Caverns NP	No Rule			https://www.nps.gov/cave/learn/management/upload/2023-CAVE-Superintendent-s-Compendium-version-6–29–2023_CC.pdf

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Channel Islands NP	No Rule			https://www.nps.gov/chis/learn/management/upload/Superintendent-s-Compendium-FEB-29–2024.pdf
Congaree NP	1 liter per person per day	Must be edible. Must be collected by hand for personal use or consumption. Possession and consumption is restricted to park boundaries.	Limitations have been imposed to "balance the visitor experience against the natural ecosystem."	https://www.nps.gov/cong/learn/management/upload/CONG-Supt-Compendium-4–3-2023-Signed.pdf
Crater Lake NP	No Rule			https://www.nps.gov/crla/learn/management/superintendent-s-compendium.htm
Cuyahoga Valley NP	No collecting allowed		36CFR § 2.1(c)(1) does not give the park authority to allow collection of fungus, as they are not plants or plant materials. Furthermore, Summit Metroparks and Cleveland Metroparks manage land within Cuyahoga Valley NP, and as neither of these organizations allow foraging, foraging also prohibited within the national park to avoid creating of a confusing patchwork of regulation.	https://www.nps.gov/cuva/learn/management/superintendents-compendium.htm
Death Valley NP	No Rule			https://www.nps.gov/deva/learn/management/rules-and-regulations.htm

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Denali NP	No restriction on harvesting edible mushrooms for personal use or consumption	Must be edible. Must be collected by hand for personal use or consumption.	Restrictions on harvesting are minimal in order to allow "the broadest use and enjoyment of the park" so long park plants, animals, and resources are not harmed.	https://www.nps.gov/locations/alaska/upload/DENA_Compendium.pdf
Dry Tortugas NP	No rule			https://www.nps.gov/drto/learn/management/superintendent-s-compendium.htm
Everglades NP	No rule			https://www.nps.gov/ever/learn/management/compendium.htm
Gates of the Arctic NP&P	No rule			https://www.nps.gov/locations/alaska/upload/GAAR_Compendium.pdf
Gateway Arch NP	No rule			https://www.nps.gov/jeff/learn/management/superintendent-s-compendium-for-2023.htm
Glacier NP	No collecting allowed		Mushroom harvesting activity might cause damage to fire areas and other recovering park resources. Removing mushrooms also adversely impacts mushroom reproduction.	https://www.nps.gov/glac/learn/management/compendium.htm
Glacier Bay NP&P	No rule			https://www.nps.gov/locations/alaska/upload/GLBA_Compendium.pdf
Grand Canyon NP	No rule			https://www.nps.gov/grca/learn/management/upload/grca-supt-compendium.pdf
Grand Teton NP	1 quart per species per person per day	Must be edible. Must be collected by hand for personal use or consumption. Possession and consumption of is restricted to park boundaries.	Harvesting for "immediate personal use" at the set limit has been determined to not be harmful to park animals, plants, or resources.	https://www.nps.gov/grte/learn/management/upload/GRTE-Compendium-2024.pdf

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Great Basin NP	No rule			https://www.nps.gov/grba/learn/management/superintendent-s-compendium.htm
Great Sand Dunes NP	2 pounds per person per calendar year	Must be edible. Must be collected by hand for personal use or consumption.	Harvesting for personal use at the set limits has been determined not to create "undue competition" with animals for food.	https://www.nps.gov/grsa/learn/management/upload/greatsanddunes-park-compendium-2023–508.pdf
Great Smoky Mountains NP	1 pound per person per day for all fungal species	Harvested mushrooms: Must be more than 100 ft from roads and other infrastructure; must be more than 200 ft from certain trails and study areas; must be edible species; must be fruiting bodies growing on soil or logs on the ground and must not be underground or on standing trees. Must be collected by hand for personal use or consumption. Commercial use is expressly prohibited.	Unrestricted harvesting could harm mushroom reproduction or wildlife food sources. Harvesting near certain trails could "irreversibly impact" scenery. Collecting near research areas could harm research results.	https://www.nps.gov/grsm/learn/management/superintendent-s-compendium.htm
Guadalupe Mountains NP	No rule			https://www.nps.gov/gumo/learn/management/superintendents_compendium.htm
Haleakala NP	No rule			https://www.nps.gov/hale/learn/management/upload/Superintendents-Compendium-FY-2024.pdf
Hawaii Volcanoes NP	No rule			https://www.nps.gov/havo/learn/management/superintendents-compendium.htm

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Hot Springs NP Hot Springs, con't	1 pint per person per day	Must be edible. Must be cut, not dug or pulled. Must be collected by hand for personal use or consumption.	As mushrooms are abundant, harvesting has been determined to not be harmful to park animals, plants, or resources.	https://www.nps.gov/hosp/learn/management/superintendents-compendium.htm
Indiana Dunes NP	No rule			https://www.nps.gov/indu/learn/management/compendium.htm
Isle Royale NP	4 quarts per person per day	Must be collected by hand for personal use or consumption. Not explicitly required to be edible.	Restrictions on harvesting are minimal in order to allow "the broadest use and enjoyment of the park" so long park plants, animals, and resources are not harmed.	https://www.nps.gov/isro/learn/management/superintendents-compendium.htm
Joshua Tree NP	No rule			https://www.nps.gov/jotr/learn/management/superintendents-compendium.htm
Katmai NP&P	No rule			https://www.nps.gov/locations/alaska/upload/KATM_Compendium.pdf
Kenai Fjords NP	No rule			https://www.nps.gov/locations/alaska/upload/KEFJ_Compendium.pdf
Kobuk Valley NP	No rule			https://www.nps.gov/locations/alaska/upload/WEAR_Compendium.pdf
Lake Clark NP	No rule			https://www.nps.gov/locations/alaska/upload/LACL_Compendium.pdf
Lassen Volcanic NP	No rule			https://www.nps.gov/lavo/learn/management/compendium.htm

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Mammoth Cave NP	1 gallon per person per day	Limit is for all species, combined, including morels. Fungi must be collected in a mesh container. Inedible fungi (not consumed in their entirety by humans and which may be extremely toxic) may not be collected. Must be collected by hand for personal use or consumption. Commercial use is expressly prohibited.	Small scale harvesting enhances visitor enjoyment and does not harm park animals, plants, or resources. A mesh container is required so that fungal spores may be spread as a harvester collects.	https://www.nps.gov/maca/learn/management/superintendents-compendium.htm
Mesa Verde NP	No rule			https://www.nps.gov/meve/learn/management/upload/MEVE-Compendium-3–8-22.pdf
Mount Rainier NP	1 gallon per person per day	Must be edible. Must be collected by hand for personal use or consumption.	Small scale harvesting does not harm park animals, plants, or resources.	https://www.nps.gov/mora/learn/management/upload/MORA-Compendium-03072023_508_signed.pdf
New River Gorge NP	1½ gallon per person per day	Must be edible. Must be for personal consumption.	Small scale harvesting for personal use is sustainable.	https://www.nps.gov/neri/learn/management/superintendents-compendium.htm
North Cascades NP North Cascades (con't)	1 liter (1.0 quart) per person per day	Must be edible. Must be collected by hand for personal use or consumption.	Small scale harvesting does not harm park animals, plants, or resources.	https://www.nps.gov/noca/learn/management/superintendent-compendium.htm

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Olympic NP	1 quart per person per day	Must be edible. Must be collected by hand for personal use or consumption. Must be more than 200 ft from certain trails and study areas. Non-personal use is expressly prohibited.	Small scale harvesting does not harm park animal food sources or plants. If consumptive use is later found to be harmful, it will be rescinded.	https://www.nps.gov/olym/learn/management/superintendent-s-compendium.htm
Petrified Forest NP	No rule			https://www.nps.gov/pefo/learn/management/superintendent-s-compendium.htm
Pinnacles NP	No limit	Must be edible. Possession and consumption is restricted to park boundaries.	Harvesting does not harm park animals, plants, or resources.	https://www.nps.gov/pinn/learn/management/upload/2022-PINN-Superintendent-s-Compendium-signed.pdf
Redwood NP	No rule			https://www.nps.gov/redw/learn/management/superintendent-s-compendium.htm
Rocky Mountains NP	No collecting allowed		Edible mushrooms are protected under 36 CFR 2.1(c)(1)(i)	https://www.nps.gov/romo/learn/management/upload/2024-Compendium.pdf
Saguaro NP	No rule			https://www.nps.gov/sagu/learn/management/upload/SAGU-Superintendent-s-Compendium-2024_508-Compliant-signed.pdf
Sequoia and Kings Canyon NPs	1 pint per person per day	Must be edible. Must be cut, not pulled. Must be collected by hand for immediate consumption. May be collected wherever found.	Limited harvesting will not impact regeneration.	https://www.nps.gov/seki/learn/management/superintendent-s-compendium.htm

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Shenandoah NP	1 gallon per person per day of morel mushrooms (*Morchella spp.*) and 1 quart per person per day of all other edible mushrooms	Must be edible. Must be collected by hand for personal use or consumption. Inedible fungi (fungi not eaten in their entirety, typically woody shelf fungus) may not be collected.	Small scale harvesting enhances visitor enjoyment and does not harm park animals, plants, or resources.	https://www.nps.gov/shen/learn/management/compendium.htm
Theodore Roosevelt NP	1 quart per person per day	Must be a wild mushroom. Must be collected by hand for personal use or consumption.	Small scale harvesting is unlikely to harm park resources. If conditions change or harvested volume increases, collection may be further restricted.	https://www.nps.gov/thro/learn/management/superintendent-s-compendium.htm
Virgin Islands NP	No rule			https://www.nps.gov/viis/learn/management/compendium.htm
Voyageurs NP	1 gallon per person per day	Must be collected by hand for personal use or consumption.	These organisms are resilient and will produce annually or regenerate.	https://www.nps.gov/voya/learn/management/superintendents-compendium.htm
White Sands NP	No rule			https://www.nps.gov/whsa/learn/management/superintendents compendium.htm
Wind Cave NP	No collecting allowed		The prohibition on mushroom harvesting is not specifically justified in the compendium.	https://www.nps.gov/wica/learn/management/superintendent-s-compendium.htm
Wrangell - St. Elias NP&P	Two 5-gallon containers of whole, fresh mushrooms per person per day	Must be for personal use.	The rule on mushroom harvesting is not specifically justified in the compendium.	https://www.nps.gov/locations/alaska/upload/WRST_Compendium.pdf

Name of Park	Amount of Fungi Allowed	Under what terms	Summary of Determining Factors	Link to Compendium
Yellowstone NP	1 quart per species per person per day	Must be collected for personal use or consumption. Possession and consumption are restricted to park boundaries. A requirement to collect by hand is not specified.	Harvesting mushrooms at the set limit has been determined to not be harmful to park animals, or plants. Harvesting provides the public a unique recreational experience.	https://www.nps.gov/yell/learn/management/upload/Yellowstone-Superintendent-s-Compendium-Signed-December-14–2023.pdf
Yosemite NP	1 pint per person per day	Must be collected by hand for personal use or consumption. May be collected wherever found. Must be cut, not pulled.	The rule on mushroom harvesting is not specifically justified in the compendium.	https://www.nps.gov/yose/learn/management/upload/yose-compendium.pdf
Zion NP	No rule			https://www.nps.gov/zion/learn/management/upload/Final-2023-Superintendent-s-Compendium.pdf

NP = National Park; NPs = National Parks; NP&P = National Park & Preserve

For most parks, rules on mushroom harvesting (if present) are located in 36 CFR 2.1(c). For Wrangell St. Elias NP&P, it is under 36 CFR 13.35 (f)(1)