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Via Federal eRulemaking Portal

Public Comments Processing
United States Fish and Wildlife Service
5275 Leesburg Pike
Falls Church, VA 22041-3803

Re: Proposed Regulations for Listing Endangered and Threatened Species and Designating Critical Habitat, Docket No. FWS-HQ-ES-2020-0047

Dear Secretary Bernhardt and Secretary Ross:

On behalf of the Animal Welfare Institute ("AWI"), we submit the following comments in opposition to the proposal of the U.S. Fish and Wildlife Service ("USFWS") and the National Marine Fisheries Service ("NMFS") (collectively the "Services") to add a definition of "habitat" to the implementing regulations of the Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544, ("ESA" or "Act"). 85 Fed. Reg. 47,333 (Aug. 5, 2020).

AWI is a nonprofit charitable organization founded in 1951 and dedicated to reducing animal suffering caused by people. AWI engages policymakers, scientists, industry, and the public to achieve better treatment of animals everywhere—in the laboratory, on the farm, in commerce, at home, and in the wild. This is accomplished through public education, research, collaborations with like-minded organizations, media relations, outreach to agencies, engaging its members and supporters, advocating for stronger laws both domestically and internationally, and through litigation.

The Services propose to define the term "habitat" for the first time in the nearly fifty years since the ESA was passed in 1973. This novel definition would form the basis for designating critical habitat for threatened and endangered species. The definition of "habitat" that the Services choose to adopt has broad implications for species' recovery under the Act. Recent reports[1] on the unprecedented rate of biodiversity loss in the United States and globally, which is primarily driven by habitat destruction, makes it clear that the areas the Services select to protect, and the nature of those protections, are critical to preventing extinction and ensuring

[1] *See, e.g.*, IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). Available at: https://ipbes.net/global-assessment (revealing that approximately 1 million animal and plant species are threatened with extinction, more than ever before in human history).

the long-term security of species. An unduly narrow definition that excludes habitat that is degraded but able to be suitably restored, or areas that are likely to become habitat in the foreseeable future as species' ranges shift due to climate change and habitat destruction, would leave areas that are essential to species recovery unprotected. Both the proposed preferred definition of "habitat," as well as the proposed alternate definition, are exactly such unduly narrow definitions that would imperil species. AWI therefore urges the Services to withdraw the proposal.

I. Introduction and Legal Background

Congress passed the ESA in 1973 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 . . . ." 16 U.S.C. § 1531(b). Under Section 7 of the ESA, Congress charged every federal agency with the duty to conserve imperiled species, which the ESA explicitly elevates over the primary missions of federal agencies. 16 U.S.C. § 1536(a). In furtherance of this duty, the ESA requires every federal agency to obtain a review of and clearance for activities that may affect listed species or their habitat from USFWS or NMFS. If an activity authorized, funded, or carried out by a federal agency may affect a listed species or its designated critical habitat, then that activity cannot go forward until consultation with USFWS or NMFS occurs to ensure that it will not jeopardize the species or result in the destruction or adverse modification of designated critical habitat. 16 U.S.C. § 1536(a)(2); 50 C.F.R. § 402.14(a).

At the same time as a species is listed as threatened or endangered, the Services must designate and protect critical habitat for the species, subject to certain exceptions. 16 U.S.C. § 1533(a)(3), (b)(2). The listing and designation of critical habitat provisions are contained in Section 4 of the ESA – the section Congress labeled the "cornerstone of effective implementation" of the Act. S. Rep. No. 97-418, at 10 (1982). Congress expressly recognized the value of protecting critical habitat when it enacted the ESA, stating:

> Man can threaten the existence of species of plants and animals in any of a number of ways . . . . The most significant of those has proven also to be the most difficult to control: the destruction of critical habitat . . . . There are certain areas which are critical which can and should be set aside. It is the intent of this legislation to see that our ability to do so, at least within this country, is maintained.

H.R. Rep. No. 412, 93d Cong., 1st Sess. 5 (1973).

In 1976, Congress again articulated the importance of designating critical habitat and prohibiting adverse modification of critical habitat:

> It is the Committee's view that classifying a species as endangered or threatened is only the first step in insuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence. Once a habitat is so designated, the Act requires that proposed federal actions not adversely affect the habitat. If the protection of endangered and threatened species

> depends in large measure on the preservation of the species' habitat, then the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat.

H.R. Rep. No. 887, 94th Cong., 2d Sess. 3 (1976).

The U.S. Supreme Court has also long recognized the great importance of habitat to species recovery. In the landmark case *Tennessee Valley Authority v. Hill*, the Court held that the intent of Congress in drafting the ESA was to "halt and reverse the trend toward species extinction, whatever the cost." 437 U.S. 153, 184–85 (1978). The Court upheld protection of the endangered snail darter and its habitat over other "primary missions" of federal agencies. *Id.* Key to the Court's decision was the fact that the completion of the Tellico Dam would destroy not just the population of snail darters, but its critical habitat as well. *Id.* at 171. Despite more than $100 million taxpayer dollars having been invested in the project, the Court reasoned that operation of the dam would clearly not "*insure* that [federal actions] do not *jeopardize*" a species' continued existence or "*result* in the destruction or modification" of its habitat. *Id.* at 173 (emphasis in original) (*citing* 16 U.S.C. § 1536). The Court declared that "[t]his language admits no exception." *Id.*

"Critical habitat" is defined in the Act, and is divided into two categories: occupied and unoccupied. Occupied critical habitat includes "the specific areas within the geographical area occupied by the species, at the time it is listed . . . on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection." 16 U.S.C. §1532(5)(A)(i). Unoccupied critical habitat includes "specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species." *Id.* § 1532(5)(A)(ii).

However, Congress did not define the term "habitat," and federal courts, prior to the U.S. Supreme Court's 2018 decision in the *Weyerhaeuser* case, had not addressed what "habitat" means under the ESA either.[2] *Weyerhaeuser Co. v. U.S. Fish & Wildlife Serv.*, 139 S. Ct. 361 (2018). While the Supreme Court did not address this question head-on, it held that "[o]nly the 'habitat' of endangered species is eligible for designation as critical habitat." *Id.* at 368. Simply put, "habitat" must encapsulate "critical habitat." *Id.* ("'critical habitat' is a subset of habitat that is 'critical' to the conservation of an endangered species"). The Court also did not address the question of whether unoccupied habitat must be "habitable" at the time it is designated as critical habitat.

The *Weyerhaeuser* decision must, however, be viewed within the broader context of the ESA's purpose and structure, including its sweeping definition of "conservation," as well as Congress's clear intent to protect habitat. As described above, the ESA's purpose is to conserve threatened and endangered species and the ecosystems upon which they depend. 16 U.S.C. § 1531(b). "Conservation" is defined as "the use of all methods and procedures which are necessary to bring any endangered species or threatened

[2] Notably, several cases discussing critical habitat designations conflate the terms "critical habitat" and "habitat." *See, e.g.*, *Lujan v. Defenders of Wildlife*, 112 S. Ct. 2130 (1993); *Palila v. Hawaii Dep't of Land & Natural Resources*, 852 F.2d 1106 (9th Cir. 1988).

species to the point at which the measures provided pursuant to this chapter are no longer necessary." 16 U.S.C. § 1532(3). Congress clearly intended these broad principles of conservation to apply to the protection of habitat, which Congress deemed the "cornerstone of effective implementation" of the Act. S. Rep. No. 97-418, at 10 (1982). Congress further recognized that the "ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat." H.R. Rep. No. 887, 94th Cong., 2d Sess. 3 (1976). Congress also required USFWS and NMFS to utilize the "best scientific data available" in designating critical habitat. 16 U.S.C. § 1533(b)(1)(A). Principles of ecology, such as the life-cycle requirements of species, trophic cascades, genetics, land-use practices, fragmentation, reproduction, dispersal, adaptation, predator-prey interactions, disease, natural disasters, pollution, and other factors must therefore inform the Services' decision.

Any definition of habitat must be consistent with Congress's expansive perspective regarding the protection of species and their habitat. As such, to further the purpose of the ESA, habitat must be defined broadly to avoid unduly restricting the areas that can be designated as critical habitat and to ensure species recovery. As written, the preferred and alternate definitions fail on both counts.

II. The Services' Proposed Definitions

The plain language of both of the proposed definitions is overly restrictive as well as arbitrary and capricious. The definitions are inconsistent with the purpose of the ESA and case law interpreting it. The definitions are also inadequate for ensuring species recovery in the wake of climate change and changing landscapes. Therefore, neither the preferred nor the alternate definitions should be adopted.

The Services propose to define "habitat" as follows: "[t]he physical places that individuals of a species depend upon to carry out one or more life processes. Habitat includes areas with existing attributes that have the capacity to support individuals of the species." 85 Fed. Reg. at 47,334. The Services also propose the following alternate definition: "[t]he physical places that individuals of a species use to carry out one or more life processes. Habitat includes areas where individuals of the species do not presently exist but have the capacity to support such individuals, only where the necessary attributes to support the species presently exist." *Id.*

AWI objects to the preferred and alternate definitions for three primary reasons: (1) the proposed definitions' plain language is arbitrary and capricious; (2) the proposed definitions are inconsistent with the ESA's purpose and court interpretations of critical habitat; and (3) the proposed definitions are arbitrary and capricious because the Services failed to consider relevant scientific evidence.

A. The Plain Language of the Proposed Definitions Is Arbitrary and Capricious

First, AWI is concerned about the proposed use of the phrase "existing attributes." This phrase is not appropriate to include in the definition of habitat. The Services do not explain the basis for including this restriction, or define or otherwise clarify the meaning of this term, which creates regulatory uncertainty. Due to this lack of explanation, the plain meaning of each word

would be given effect. *See, e.g.*, *Estate of Cowart v. Nicklos Drilling Co*., 112 S. Ct. 2589, 2594 (1992); *United States v. Providence Journal Co*., 485 U.S. 693, 700-01 (1988). To determine plain meaning, the courts commonly turn to the dictionary definition of words. *Nix v. Hedden*, 149 U.S. 304, 306-7 (1893); *Wisconsin Central Ltd. v. United States*, 138 S.Ct. 2067, 2070 (2018). Merriam-Webster defines "existing" as: "(1)(a) to have real being whether material or spiritual; (1)(b) to have being in a specified place or with respect to understood limitations or conditions; (2) to continue to be; (3)(a) to have life or the functions of vitality; (3)(b) to live at an inferior level or under adverse circumstances."[3] Merriam-Webster defines "attributes" as: "(1) a quality, character, or characteristic ascribed to someone or something; (2) an object closely associated with or belonging to a specific person, thing, or office; (3) a word ascribing a quality."[4] The ordinary meaning of these words provide little insight into the Services' intent, particularly considering the ESA's scientific and legal framework, and leaves vital questions unanswered. The Services should address the following questions:

1. Why are the Services limiting the definition of habitat to include only "existing attributes"?

2. What is the legal basis for this limitation?

3. What is the scientific basis for this limitation?

4. What attributes will the Services consider when determining whether an area constitutes habitat?

5. How many attributes must an area contain to be considered habitat?

6. How do "existing attributes" apply to restored habitats?

7. How do "existing attributes" take into account habitats that have been degraded?[5]

8. How do "existing attributes" ensure species' recovery in the wake of climate change, habitat loss, and natural disasters?

9. To what timeframe does "existing" refer? For example, existing as of the time the species is listed; existing as of the time critical habitat is designated; or existing as of some other timeframe.

Second, AWI is concerned about the Services' use of the word "capacity" for similar reasons. The word "capacity" is vague, and the proposal does not explain how the Services intend to interpret this word in the context of determining what areas qualify as habitat for a particular species. As stated above, the default is therefore to rely on the plain meaning of the

[3] Merriam-Webster Dictionary online, "Existing" Available at: https://www.merriam-webster.com/dictionary/existing.
[4] Merriam-Webster Dictionary online, "Attributes" Available at: https://www.merriam-webster.com/dictionary/attributes.
[5] Note that in *Weyerhaeuser*, USFWS itself argued that habitat includes areas that would require some degree of modification to support a sustainable population of a species. 139 S. Ct. 361, 369.

word. Merriam-Webster defines "capacity" as: "(1) legal competency; (2)(a) the potential or suitability for holding, storing, or accommodating; (2)(b) the maximum amount or number that can be contained or accommodated; (3)(a) an individual's mental or physical ability; (3)(b) the faculty or potential for treating, experiencing, or appreciating; (4) duty, position, role; (5) the facility or power to produce, perform, or deploy."[6] Again, the plain meaning of this word provides little insight into the Services' intent, particularly considering the ESA's scientific and legal framework, and still results in ambiguity. If interpreted narrowly, "capacity" could mean that only areas with all necessary attributes to support an individual can be considered "habitat." This interpretation could limit designation of marginal, edge, or restored habitat. However, if "capacity" is interpreted broadly, it could mean that both optimal *and* marginal, edge, and restored habitats could be considered habitat. The potential for multiple interpretations, as well as the lack of explanation of the legal or scientific basis for this word, renders the definition arbitrary and capricious.

Third, AWI is concerned about adoption of the phrase "depend upon." The Services specifically inquire as to whether "depend upon" in the preferred definition sufficiently differentiates areas that could be considered habitat, or whether "use" better describes the relationship between a species and its habitat. 85 Fed. Reg. at 47,334. The adoption of either "depend upon" or "use" needlessly and arbitrarily limits which physical places may be considered "habitat," which is contrary to Congressional intent and the purpose of the ESA. The Services do not adequately explain the meaning and purpose of the phrase "depend upon." As such, the Services do not provide the reasoned basis necessary to determine how this phrase will influence implementation of the proposed regulation.

"Depend upon" could be interpreted either narrowly or broadly, but the Services provide no context about their intent or explanation as to the phrase's scope. For example, would the Services interpret "depend upon" to mean that a species would be unable to survive without this physical place, or to mean that the species generally benefits from this place? Furthermore, the Services fail to make clear whether this phrase encompasses a time component. For example, a species may not depend upon a particular area at the time critical habitat is designated; however, the species may later come to depend upon that area as its then-occupied habitat is degraded, destroyed, or otherwise becomes unsuitable due to climate change, severe weather events, shifting location of prey, etc. The proposed definition does not provide the flexibility necessary to recover species in the face of these challenges, as will be discussed further later in this comment.

Adoption of the word "use" does not provide a meaningful alternative to the phrase "depend upon" and raises similar issues. While the Services attempt to explain what is meant by the term "use" in the Federal Register notice, adoption of this word could be even more problematic than "depend upon." Many species protected by the ESA have aspects of their life cycles that scientists do not fully understand, or that may change substantially over time due to an array of influences like weather, natural disasters, and climate change. The scientific community's lack of knowledge about species' "use" of a particular location could thus limit the conception of species' habitats to mere a snapshot in time. This does not provide the flexibility

[6] Merriam-Webster Dictionary online, "Capacity" Available at: https://www.merriam-webster.com/dictionary/capacity.

necessary to accommodate developments in scientific knowledge and to address shifts in species' behavior due to weather, natural disasters, and climate change. Relatedly, species with a particularly large range, such as migratory birds and many marine mammals, may not "use" a physical place regularly or even within a generation, yet that location could be important to the species' recovery in the future. AWI is similarly concerned about adoption of "use" and "depend upon" in the alternate definition. The above analysis applies to the alternate definition as well.

Additionally, AWI is concerned about the language of the proposed alternate definition that limits unoccupied habitat to areas "where necessary attributes to support the species presently exist." This phrase is ambiguous and unduly narrow. It is unclear from the Federal Register notice what the Services mean by "necessary attributes," how the Services will determine what constitutes a "necessary attribute," and whether this phrase will be interpreted to mean at least one "necessary attribute" or all "necessary attributes." As written, it appears that the plain language interpretation of the alternate proposed definition is to limit unoccupied habitat to only "move-in-ready" habitat, which is inconsistent with the purpose of the ESA and case law, as described below. The Services fail to explain the legal or scientific basis for this definition, and as such, it is arbitrary and capricious.

B. The Proposed Definitions are Inconsistent with the Purpose of the ESA and Court Interpretations of Critical Habitat

As stated above, in drafting the ESA, Congress was aware that habitat modification and destruction was the main driver of species extinction. S. Rep. No. 93-307, at 2 (1973). As such, Congress made habitat protection a major component of the law by stating specifically that its purpose is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." 16 U.S.C. § 1531(b). Combined with the Act's expansive definition of "conservation," *id.* § 1532(3), it is clear that any definition of "habitat" must ensure species recovery, not merely survival. *See, e.g.*, *Sierra Club v. US Fish & Wildlife Serv.*, 245 F.3d 424, 438 (5th Cir. 2001). As written, however, both the preferred and alternate definitions fail to meet this bar.

As stated above, according to the Supreme Court, "[o]nly the 'habitat' of endangered species is eligible for designation as critical habitat." *Weyerhaeuser Co. v. U.S. Fish & Wildlife Serv.*, 139 S. Ct. 361, 368 (2018). Therefore, "habitat" must be defined more broadly than "critical habitat." As currently written, however, the proposed preferred definition of habitat is narrower than the definition of critical habitat and can thus not be adopted. The proposed definition of habitat is limited to areas with "existing attributes." However, the ESA's definition of "critical habitat," as well as court interpretations, include areas that "are essential for the conservation of the species." 16 U.S.C. §1532(5)(A)(i). This has been interpreted to include habitat that does not necessarily have all "existing attributes" to support the recovery of the species. *See, e.g.*, *New Mexico Farm & Livestock Bureau v. U.S. Dep't of Interior*, 952 F.3d 1216, 1232 (10th Cir. 2020) ("it is not inconsistent for the Service to find [some areas] are 'secondary' or 'marginal' habitat *and* that they are essential for the conservation of the jaguar") (emphasis added).

The same could be said of the alternate proposed definition, which expressly limits unoccupied habitat to areas only where necessary attributes to support the species presently exist.

The alternate definition explicitly excludes areas that have no present capacity to support individuals of the species. As stated above, under this definition, a habitat would need to be "move-in ready" to be considered unoccupied habitat. This requirement is very similar to the preferred definition's unlawful limitation on habitat—occupied or not—to only areas with "necessary attributes" that "presently exist." In defining "unoccupied critical habitat," Congress did not require critical habitat to have "physical or biological features" (i.e. "necessary attributes" or "existing attributes" in the proposed definitions) essential to species conservation. Instead, it only requires that a "determination . . . that such areas are essential for the conservation of the species" be made by the Secretary. *Compare* 16 U.S.C. § 1532(5)(A)(i) *with* 16 U.S.C. § 1532(5)(A)(ii).

The U.S. Court of Appeals for the Ninth Circuit rejected such a limitation on critical habitat designation in *Bear Valley Mutual Water Co. v. Jewell*, 790 F.3d 977 (9th Cir. 2015). At issue in this case was USFWS's designation of both occupied and unoccupied, uninhabitable areas as critical habitat for the Santa Ana sucker. Specifically, USFWS included certain unoccupied areas upstream of the river segment where sucker populations lived as critical habitat. The unoccupied upstream areas were designated because they provided coarse sediment essential to creating spawning and feeding grounds, "convey[e]d stream flows and flood waters necessary to maintain habitat conditions . . . and support[ed] riparian habitats that protect water quality in the downstream portions of the Santa Ana River occupied by the sucker." *Id.* at 983-84. The appellants argued that designation of this unoccupied land was arbitrary and capricious because "uninhabitable source areas do not meet the statutory requirement for critical habitat." *Id.* at 994. The court held: "[t]here is no support for this contention in the text of the ESA or the implementing regulation, which requires the Service to show that the area is 'essential,' without further defining that term as 'habitable.'" *Id.* Therefore, even though the unoccupied critical habitat did not have all "necessary attributes" or "existing attributes" to support habitation by the species, it was nevertheless critical habitat. Thus, the Services' proposed preferred and alternate definitions, which are at best ambiguous as to whether an area must have some or all "existing" or "necessary" attributes to be considered habitat, are inconsistent with case law interpreting "critical habitat." Furthermore, because "habitat" must encapsulate "critical habitat," defining "habitat" more narrowly than court interpretations of "critical habitat" is unlawful.

Finally, the definition of critical habitat has also been interpreted by the courts and the Services to encapsulate massive landscapes. *See, e.g.*, *Alaska Oil & Gas Ass'n v. Jewell*, 840 F.3d 671 (9th Cir. 2016) (upholding a critical habitat designation for the polar bear that measured 187,000 square miles); *Ariz. Cattle Growers' Ass'n v. Salazar*, 606 F.3d 1160 (9th Cir. 2010) (upholding a critical habitat designation for the Mexican spotted owl of 8.6 million acres); *Colorado Through Colorado Dep't of Natural Resource v. US Fish & Wildlife Serv.*, 362 F.Supp.3d 951 at 984–86 (D. Colo. 2018) (upholding a critical habitat designation for the Gunnison sage-grouse of 1.62 million acres). Thus, the preferred and alternate proposed definitions, which will restrict designations of critical habitat substantially, are at odds with precedent construing critical habitat broadly.

C. The Proposed Definitions are Arbitrary and Capricious because the Services Failed to Consider Relevant Scientific Evidence and are Not Scientifically Justified

The proposed preferred and alternate definitions are both arbitrary and capricious because the Services failed to adequately consider scientific evidence when developing the proposals. Specifically, the Services did not disclose what scientific literature they considered in developing the proposals, and the Services fail to discuss scientific evidence on climate change and habitat destruction. The latter is relevant to the development of a definition that is flexible enough to allow for recovery of species even as climate change alters, degrades, and limits species' habitat.

First, the Services do not provide a meaningful explanation of the process that they went through to evaluate the scientific literature to develop the definitions, which is essential for the public to fully understand the impacts of the proposed action and to permit the public to provide substantive and informed comments. Instead, the Services provided the following statement in the Federal Register notice:

> The proposed definition reflects the principle that a species' habitat is based on its particular ecology. In developing this particular definition of habitat, we reviewed many definitions of habitat from the ecological literature; however, no pre-existing definition was adequate to address the particular regulatory framework that we are implementing. Therefore, we incorporated useful concepts from the literature to the extent appropriate and added concepts based on our decades of expertise so as to define the term ''habitat'' in a manner that would be sufficiently broad to fully encompass both the occupied and unoccupied prongs of the definition of "critical habitat" in the Act.

85 Fed. Reg. at 47,334.

The Services do not explain how the proposed preferred and alternate definitions "reflect[] the principle that a species' habitat is based on its particular ecology," nor do the Services identify what "ecological literature" they reviewed or explain why no existing definition was adequate. This deprives the public of the opportunity to determine the veracity of this claim, to offer an alternate interpretation of the literature, and to provide the Services with additional published studies that would be useful to the development of a definition that will affect how the nation's most important safeguard for imperiled species is implemented. At a minimum, the Services should have included a list of citations in the proposed rule or provided a link in the notice where interested parties could find such information.

Second, and more importantly, if the Services evaluated species ecology in developing the definitions, they ignored the reality of ongoing and, in some cases, abrupt alterations to that ecology because of changes to the environment. Ecology is not static; it is dynamic and constantly changing in response to both natural and human-caused impacts to an ecosystem. The fundamental driver of such change and the preeminent threat to the survival of most species is

habitat loss and fragmentation.[7] Natural factors such as a short or long-term changes in weather patterns (e.g., extended drought) or naturally occurring stochastic events can cause habitat loss and fragmentation. More commonly, habitat loss and fragmentation are tied to anthropogenic factors including land use practices, development, pollution, and recreational activities. In recent decades, climate change has exacerbated and accelerated the loss and fragmentation of habitat, including designated critical habitat, forcing species to rapidly adapt behaviorally, ecologically, and genetically to the changing conditions, or to shift their distribution or range to find suitable habitat to meet their biological needs.[8]

Natural disasters, including hurricanes, floods, and wildfires, can also damage habitat and adversely affect wildlife, and must be considered in developing a definition of "habitat." Numerous studies indicate that hurricanes and tropical storms have increased in frequency and strength due to climate change, leading to increased levels of flooding and other damage, a trend that will continue in the future.[9] Hurricane impacts on wildlife include direct effects such as mortality due to exposure to hurricane-force winds, rain, and storm surges, and spatial displacement due to storm winds, as well as indirect effects, including loss of food or foraging substrates, loss of nesting or roosting sites, increased vulnerability to predation, changes in microclimates, and increased human-wildlife conflict.[10]

Similarly, wildfires destroy habitat that protected species rely on,[11] and are becoming more frequent, severe, and destructive due to climate change.[12] The impact of wildfires on wildlife depend on the fire severity, intensity, rate of spread, size, uniformity, and location (i.e., crown or ground). In general, such impacts can include injury, mortality, immigration, or emigration, with young animals and other species with limited mobility being more vulnerable to

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[7] Haddad, N.M., et al. 2015. Habitat fragmentation and its lasting impact on Earth's ecosystems. Scientific Advances, 1:e1500052; Fahrig. L. 2003. Effects of habitat fragmentation on biodiversity. Annu. Rev. Ecol. Evol. Syst. 34:487–515, doi: 10.1146/annurev.ecolsys.34.011802.132419; Segana, D.B., Murray, K.A., and Watson, J.E.M. 2016. Habitat fragmentation and biodiversity conservation: key findings and future challenges. Global Ecology and Conservation, 5:12-21; Wilson, M.C., et al. 2016. Habitat fragmentation and biodiversity conservation: key findings and future challenges. Landscape Ecology, 31:219-227; Hanski, I. 2011. Habitat loss, the dynamics of biodiversity, and a perspective on conservation. AMBIO, 40:248–255, DOI 10.1007/s13280-011-0147-3.

[8] Mantyka-Pringle, C.S., et al. 2015. Climate change modifies risk of global biodiversity loss due to land-cover change. Biological Conservation, 187: 103-111; Travis, J.M.J. 2003. Climate change and habitat destruction: a deadly anthropogenic cocktail. Proc. R. Soc. Lond. B., 270:467-473.

[9] *See, e.g.*, Risser, M.D. and Wehner, M.F. 2017. Attributable human-induced changes in the likelihood and magnitude of the observed extreme precipitation during Hurricane Harvey, 44 Geophysical Research Letters 12,457. Available at: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017GL075888; Lin, N. et al., 2012. Physically based assessment of hurricane surge threat under climate change. 2 Nature Climate Change 462. Available at: https://dspace.mit.edu/bitstream/handle/1721.1/75773/kerry%20paper%204.pdf?sequence=1&isAllowed=y; Bjarnadottir, S. et al., 2011. A probabilistic-based framework for impact and adaptation assessment of climate change on hurricane damage risks and costs. 33 Structural Safety 173. Available at: https://doi.org/10.1016/j.strusafe.2011.02.003.

[10] Wunderle, J.M., and Wiley, J.W. 1996. Effects of hurricanes on wildlife: implications and strategies for management. Chapter 9 in DeGraff, R.M. and Miller, R.I. (editors). Conservation of faunal diversity in forested landscapes. Chapman-Hall.

[11] Jhariya, M.K., and Raj, A. 2014. Effects of wildfires on flora, fauna and physic-chemical properties of soil. Journal of Applied and Natural Science, 6 (2): 887 – 897.

[12] Flannigan, M.D. et al. 2000. Climate Change and Forest Fires. Science Total Env. 262: 221-229.

injury and mortality.[13] This, in turn, can result in a reduction in species diversity and abundance and adversely impact physical and chemical properties of the soil, including pH, nutrient availability, and soil biota. Such effects influence habitat recovery time, successional stages, species composition, and productivity.[14]

The definition of "habitat" must be flexible enough to protect areas that animals may evacuate to in the face of destruction of occupied habitat due to hurricanes, wildfires, and other habitat changes that will becomes increasingly common due to climate change. If listed species are to recover, the definition of "habitat" must encompass both occupied habitat and unoccupied habitat required to mitigate habitat loss and fragmentation. Species considered ecological generalists who have a broad geographic distribution may already have the ecological and behavioral adaptability to compensate for such habitat loss and fragmentation. For these species, the definition must encompass unoccupied habitat and habitat corridors to facilitate species movement as well as presently occupied habitat. Species whose geographic ranges are restricted, who are habitat specialists, or who cannot readily adapt to human-caused changes to their habitat require a more expansive definition of "habitat." This definition must encompass both currently occupied and adjacent unoccupied habitat as well as future habitat, whether occupied or not and regardless of whether such future habitat is presently suitable to sustain the species since the ecological characteristic of habitat change over time. This would permit such species to adapt and survive in response to changing environmental and ecological conditions.

The preferred and alternate definitions of "habitat" ignore the reality of ecological change. Protecting the habitat that protected species "depend upon" or "use" is critically important, but those definitions must be expanded or clarified to include the future habitat that listed species need to survive, thrive, and recover. The proposed definitions currently provide a narrow definition of "habitat" that may cause, if either definition is finalized as written, species extinction. Instead, to satisfy the requirements of the ESA, "habitat" must include both occupied and unoccupied habitat needed by a species to satisfy its biological requirements.

Since habitats are constantly changing in response to biotic and abiotic factors, the definition must not restrict unoccupied habitat to only habitat that is currently suitable to satisfy the ecological and biological needs of a species. Such a restriction – which is included in the preferred and alternate definitions – is a fundamental flaw because it ignores the scientific reality of ecosystem change. Indeed, just as the distribution of many species has changed or is changing in response to climate change, habitats also transition in response to changing environmental conditions. Any definition of "habitat" under the ESA must reflect that reality. The preferred and alternate definitions offered by the Services foreclose the important requirement to protect habitat that may not be presently suitable to meet an imperiled species biological and ecological needs, but may become suitable in the future.

[13] Smith, J.K., ed. 2000. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42-vol. 1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 83 p.
[14] Jhariya, M.K., and Raj, A. 2014. Effects of wildfires on flora, fauna and physic-chemical properties of soil. Journal of Applied and Natural Science, 6 (2): 887 – 897.

Climate change has caused the following: polar bear population declines in Canada;[15] the extirpation of Bay checkerspot butterfly populations in the San Francisco Bay area;[16] alteration in the migration cycles and condition of migratory songbirds including decoupling migratory bird breeding phenology from food availability adversely affecting reproductive success,[17] an increase in the size and number of wildfires, insect outbreaks, disease outbreaks, and tree mortality in several regions of the country;[18] increases in water temperatures negatively impacting cold and cool water fish populations;[19] rising sea levels disrupting nesting by shorebirds and sea turtles;[20] major coral bleaching events due to increased sea water temperatures,[21] changes in the distribution of marine fish, crustacean, and invertebrates populations;[22] and altered the distribution and very survival of many marine mammal species.[23]

These impacts are all linked, directly or indirectly, to changes in habitat quality and quantity attributable to climate change. Inevitably, for some plants and other species with restricted ranges or for habitat specialists, some will not survive the adverse and increasing threat of climate change, while others may survive but only if they are able to find, access, and use suitable habitat to meet their biological and ecological needs. If that habitat is only marginal in quality, however, those species populations will likely decline in size and eventually will become functionally extinct locally, nationally, or globally. Preventing or reducing the likelihood of such an outcome is precisely why a more expansive definition of "habitat" is required.

As mentioned above, in 2019, the Intergovernmental Platform on Biodiversity and Ecosystem Services ("IPBES") published its seminal report on global biodiversity loss.[24] In that

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[15] U.S. Fish and Wildlife Service. 2008. Determination of threatened status for the polar bear (*Ursus maritimus*) throughout its range. Federal Register Vol. 73:28212-28303. May 15, 2008.

[16] McLaughlin, J.F., et al. 2002. Climate change hastens population extinctions. Proceedings of the National Academy of Sciences 99:6070-6074.

[17] Both, C., et al. 2006. Climate change and population declines in a long-distance migratory bird. Nature 414:81-83.

[18] Backlund, P., A. Janetos, and D. Schimel. 2008. The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States. Synthesis and Assessment Product 4.3. Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington, D.C. 362 pp.

[19] Field, C.B., et al. 2007. North America. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. M.L. Parry, et al. (eds.) IPCC, Geneva, Switzerland. Pages 617-652.

[20] Glick, P., J. Clough, and B. Nunley. 2008. Sea level rise and coastal habitats in the Chesapeake Bay region. Technical Report. National Wildlife Federation, Washington, DC. 121 pp.

[21] Backlund, P., A. Janetos, and D. Schimel. 2008. The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States. Synthesis and Assessment Product 4.3. Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington, D.C. 362 pp.

[22] Hollowed, A.B. et al. 2013. Impact of ocean warming and ocean acidification on marine invertebrate life history stages: vulnerabilities and potential for persistence in a changing ocean. ICES Journal of Marine Science, 70(5), 1023-1037; Byrne, M. 2011. Are fish outside their usual ranges early indicators of climate-driven range shifts? Oceanography and Marine Biology: An Annual Review, 49, 1-42; Fogarty, H.E., et al. 2017. Global Change Biology 23: 2047-2057. Kovacs, K.M., et al. 2011. Impacts of changing sea-ice conditions on Arctic marine mammals. Marine Biodiversity, 41:181-194.

[23] Kovacs, K.M., et al. 2011. Impacts of changing sea-ice conditions on Arctic marine mammals. Marine Biodiversity, 41:181-194.

[24] IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz et al. (eds.). IPBES secretariat, Bonn, Germany. 56 pages.

report, the IPBES warned of the potential imminent extinction of one million animal and plant species and called for transformational change in human use of the environment to protect remaining biodiversity. As noted in the report, based on 'bottom-up' assessments of species in the best studied taxonomic groups, the current extinction threat is driven by (in order of prevalence) land/sea use changes, direct exploitation, pollution, invasive species, and climate change.[25] In its analysis, the IPBES notes that "[c]limate change is a direct driver that is increasingly exacerbating the impact of other drivers on nature and human well-being."[26] Increasing temperatures, rising frequency and intensity of extreme weather events and associated fire, floods, and droughts, along with sea level rise have "contributed to widespread impacts in many aspects of biodiversity, including species distributions, phenology, population dynamics, community structure and ecosystem function."[27] These effects are accelerating in marine, terrestrial, and freshwater ecosystems and when combined with land/sea use change, overexploitation, pollution, and invasive species, the negative impacts on nature are exacerbated as already documented in coral reefs, in the Arctic, and savanna habitat.[28] While such human-induced changes have resulted in more rapid biological evolution, "[t]he widespread declines in geographic distribution and population sizes of many species make clear that, although evolutionary adaptation to human caused drivers can be rapid, it has often not been sufficient to mitigate them fully."[29]

Another seminal international report, published by The Intergovernmental Panel on Climate Change ("IPCC") in 2014, determined with high confidence that "[m]any terrestrial, freshwater and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances and species interactions in response to ongoing climate change."[30] Specifically, the IPCC found that:

> A large fraction of species faces increased extinction risk due to climate change during and beyond the 21st century, especially as climate change interacts with other stressors (high confidence). Most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change in most landscapes; most small mammals and freshwater mollusks will not be able to keep up at the rates projected under RCP4.5 and above in flat landscapes in this century (high confidence). Future risk is indicated to be high by the observation that natural global climate change at rates lower than current anthropogenic climate change caused significant ecosystem shifts and species extinctions during the past millions of years. Marine organisms will face progressively lower oxygen levels and high rates and magnitudes of ocean acidification (high confidence), with associated risks exacerbated by rising ocean

[25] Ichii et al. 2019. IPBES Global Assessment on Biodiversity and Ecosystem Services. 2.2 Chapter 2.2 Status and Trends – Nature (Draft).
[26] IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz et al. (eds.). IPBES secretariat, Bonn, Germany. 56 pages.
[27] *Id.*
[28] *Id.*
[29] *Id.*
[30] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

> temperature extremes (medium confidence). Coral reefs and polar ecosystems are highly vulnerable. Coastal systems and low-lying areas are at risk from sea level rise, which will continue for centuries even if the global mean temperature is stabilized (high confidence).[31]

In 2018, the U.S. Global Change Research Program published its Fourth National Climate Assessment.[32] This comprehensive report documents the current and projected adverse impacts of climate change within the United States, including its impact on biodiversity nationally and regionally. While the analysis does not provide a species-specific analysis of adverse impacts of climate change, it provides an overview of the types of impacts affecting and likely to affect biodiversity in the United States. In regards to the impacts of climate change on biodiversity, the report includes information on changes in species phenology, range, primary productivity, individual characteristics, invasive species, and species interactions and emergent properties. In regards to changes in species range attributable to climate chance, the report notes that climate change is causing large-scale shifts in the range and abundance of species which, in turn, is altering terrestrial, freshwater, and marine ecosystems.[33] Range contraction, which generally is characterized by shifts northward and upward in elevation, has been documented in half of the North American animal and plant species studied.[34] Higher elevation species are particularly affected by range shifts.[35] In the marine environment, fish have shifted their range northward or into deeper water based on their biological and ecological needs or limitations.[36]

As species vary in their ability to change their range in response to environmental variability,[37] this has the potential to restructure ecological communities. This ability of species to shift to satisfy their needs can be compromised by habitat loss and fragmentation, which can

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[31] *Id.*

[32] USGCRP. 2019. Impacts, Risks, and Adaptation in the United States. Fourth National Climate Assessment, volume II. Reidmiller, D.R. et al. (editors). US Global Change Research Program, Washington, DC, USA. 1515 pp. Available at: https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf.

[33] Groffman, P.M., et al. 2014. Chapter 8: Ecosystems, Biodiversity, and Ecosystem Services. Climate Change Impacts in the United States: The Third National Climate Assessment. Mellilo, J.M. et al., Eds. U.S. Global Change Research Program, Washington, DC, 195-219. Available at: http://dx.doi.org/10.7930/JOTD9V7H; Kleisner, K.M. et al. 2017. Marine species distribution shifts on the U.S. Northeast continental Shelf under continued ocean warming. Progress in Oceanography. 153: 24-36. Available at: http://dx.doi.org/10.1016/j.pocean.2017.04.001; Lenoir, J., and J.C. Svenning. 2015. Climate-related ranges shifts – A global multidimensional synthesis and new research directions. Ecography, 28(1): 15-28. Available at: http://dx.dio.org/10.1111/ecog.00967; Pacifici, M. et al. 2017. Species' traits influenced their response to recent climate change. Nature Climate Change, 7: 205-204. Available at: http://dx.doi.org/10.1038/nclimate3223; Walther, G.R. et al. 2002. Ecological responses to recent climate change. Nature, 416: 389-395. Available at: http://dx.doi.org/10.1038416389a.

[34] Wiens, J.J. 2016. Climate-related local extinctions are already widespread among plant and animal species. PLOS Biology, 14(12), e2001104. Available at: http://dx.doi.org/10.1371/journal.pbio.2001104.

[35] Santos, M.J. et al. 2017. The relative influence of change in habitat and climate on elevation range limits in small mammals in Yosemite National Park, California, U.S.A. Climate Change Responses, 4(1), 7. Available at: http://dx.doi.org/10.1186/s4066-017-0035-6.

[36] Walsh, J.J. et al. 2015. Long-term change in the distributions of larval and adult fish in the northeast U.S. shelf ecosystem. PLOS ONE, 10 (9), e0137382. Available at: http://dx.doi.org/10.1371/journal.pone.0137382.

[37] Pinsky, M.L. et al. 2013. Marine taxa track local climate velocities. Science, 341 (6151), 1239-1242. Available at: http://dx.dio.org/101126/science.1239352; Rogers, B.M. Jantz, P., and Goetz, S.J. 2017. Vulnerability of eastern US tree species to climate change. Global Change Biology, 23(8), 3302-3320. Available at: http://dx.doi.org/10.1111/gcb.13585; Tingley, M.W. et al. 2012. The push and pull of climate change causes heterogeneous shifts in avian elevational ranges. Global Change Biology, 18(11), 3279-3290. Available at: http://dx.doi.org/10.1111/j.1365-2486.2012.02784.x.

reduce habitat connectivity. In those circumstances "efforts to retain, restore, or establish climate corridors can . . . facilitate movements and range shifts." While some individual organisms and species can adapt to climate change by altering their behavior, physiology, or physical characteristics, rapid environmental changes may exceed the ability of species to adapt.[38] Indeed, for most species, any evolutionary response to perturbations in their environment does not occur quickly enough to counteract the adverse impacts of climate change.[39] As habitat loss and fragmentation reduce species genetic diversity and abundance, the ability of such species to adapt to such environmental changes is further compromised.[40]

The United States Forest Service has also published a series of reports assessing the impact of climate change on amphibians,[41] reptiles,[42] birds,[43] and mammals,[44] with each report documenting the need for species to alter their distribution in response to climate change. The impact of climate change on amphibians varies among amphibian taxa.[45] Rare species, species with restricted movements, and habitat specialists with limited dispersal capacity may not be able to shift their distributions in response to changes in habitat suitability.[46] Those amphibian species that require specific temperature or moisture ranges may be at particular risk of adverse impacts caused by climate change,[47] while amphibians that rely on specific habitat

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[38] Staudinger, M.D. et al. 2012. Impacts of Climate Change on Biodiversity, ecosystems, and Ecosystem Services. Technical input to the 2013 National Climate Change Assessment. U.S. Geological Survey, Reston, VA, 296 pp. Available at: https://downloads.globalchange.gov/nca/technical_inputs/Biodiversity-Ecosystems-and-Ecosystems-Services-Technical-Input.pdf.

[39] USGCRP. 2019. Impacts, Risks, and Adaptation in the United States. Fourth National Climate Assessment, volume II. Reidmiller, D.R. et al. (editors). US Global Change Research Program, Washington, DC, USA. 1515 pp. Available at: https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf.

[40] Duffy, J.E., Godwin, C.M., and Cardinarle, B.J. 2017. Biodiversity effects in the wild are common and as strong as key drivers of productivity. Nature, 549, 261-264. Available at: http://dx.doi.org/10.1038/nature23886.

[41] Olson, D.H., Saenz, D. 2013. Climate Change and Amphibians. (March, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/amphibians/

[42] Olson, D.H., Saenz, D. 2013. Climate Change and Reptiles. (March, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/reptiles/

[43] King, D., Finch, D.M. 2013. The Effects of Climate Change on Terrestrial Birds of North America. (June, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/birds.

[44] McKelvey, K.S. et al. 2013. The Effects of Climate Change on Mammals. U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/mammals.

[45] Corn, P.S. 2005. Climate change and amphibians. Animal Biodiversity and Conservation. 28:59-67; Carey, C., Alexander, M.A. 2003. Climate change and amphibian declines: is there a link? Diversity and Distributions. 9:111-121; Araujo, M.B., Thuiller, W., Pearson, R.G. 2006. Climate warming and the decline of amphibians and reptiles in Europe. Journal of Biogeography. 33:1712-1728; Reading, C. J. 1998. The effect of winter temperatures on the timing of breeding activity in the common toad *Bufo bufo*. Oecologia. 117:469-475; Wake, D.B. 2007. Climate change implicated in amphibian and lizard declines. Proceedings of the National Academy of Sciences. 104:8201-8202; Laurance, W.F. 2008. Global warming and amphibian extinctions in eastern Australia. Australia Ecology. 33: 1-9; Blaustein, A.R. et al. 2010. Direct and indirect effects of climate change on amphibian populations. Diversity. 2:281-313; Lawler, J.J. et al. 2009. Projected climate impacts for the amphibians of the Western Hemisphere. Conservation Biology. 24:38-50; Milanovich, J.R. et al. 2010. Predicted loss of salamander diversity hotspot as a consequence of projected global climate change. PLoS ONE. 5(8):1-10; McCallum, M.L. 2010. Future climate change spells catastrophe for Blanchard's cricket frog, *Acris blanchardii* (Amphibia: Anura: Hylidae). Acta Herpetologica. 5:119-130.

[46] Olson, D.H., and Saenz, D. 2013. Climate Change and Amphibians. (March, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/amphibians/INSERT CITATIONS.

[47] *Id.*

types (e.g., ephemeral ponds and streams) may be at most risk because they can experience years of reproductive failure or mass mortality events due to climate change.[48]

Reptiles, in many respects, may be more sensitive to climate change than other taxa. Because they are ectothermic, relying on ambient temperatures for proper physiological function, climate change can disrupt such processes.[49] In temperate zones, lizards are considered highly vulnerable to climate change as altered weather patterns can adversely affect their reproduction cycles, resulting in years of reproductive failure.[50] Abnormally warm winters, changes to the composition of floral communities, frequency and intensity of wildfires, increases in numbers or density of invasive species, and the spread of novel pathogens – all of which can be attributable to climate change – may cause an increase in lizard mortality.[51] For turtles and crocodilians, climate change can cause habitat fragmentation and alter water availability and its thermal properties, which harms individuals, causes population declines, and forces a range shift to potentially less suitable habitat.[52] As the sex of turtles and alligators is temperature-sensitive, warmer temperature may skew the sex ratio to females – with long-term consequences for the population.[53] Storm surges caused by more intense storms, sea level rise, and saltwater intrusion into freshwater environments may adversely impact alligators and crocodiles.[54] As reptile biodiversity is highest in the southern states, with species richness dropping precipitously as you move north, these species may not be able to shift their ranges north in response to climate change or, if they try, such marginal habitat may not successfully support such species.[55] If there are suitable habitats that reptiles could move to in response to climate change, natural obstacles and human developments may prevent such movements without the assistance of humans.[56]

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[48] Shoo, L. P. et al. 2011. Engineering a future for amphibians under climate change. Journal of Applied Ecology. 48: 487-492.

[49] Olson, D.H., and Saenz, D. 2013. Climate Change and Reptiles. (March, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/reptiles/.

[50] Araujo, M.B., Thuiller, W., Pearson, R.G. 2006. Climate warming and the decline of amphibians and reptiles in Europe. Journal of Biogeography. 33:1712-1728; Wake, D.B. 2007. Climate change implicated in amphibian and lizard declines. Proceedings of the National Academy of Sciences, 104:8201-8202; Moreno-Rueda, G. et al. 2011. Northward shifts of the distribution of Spanish reptiles in association with climate change. Conservation Biology. 26:278-283; Sinervo, B. et al. 2010. Erosion of lizard diversity by climate change and altered thermal niches. Science. 328:894-899; Huey, R., Losos, J., Moritz, C. 2010. Are lizards toast? Science. 328:832-833; Zani, P.A. 2005. Life-history strategies near the limits of persistence: winter survivorship and spring reproduction in the common side-blotched lizard (*Uta stansburiana*) in eastern Oregon. Journal of Herpetology. 39:166-169; Zani, P.A., Rollyson, M. 2011. The effects of climate modes on growing-season length and timing of reproduction in the Pacific Northwest as revealed by biophysical modeling of lizards. The American Midland Naturalist. 165: 372-388.

[51] Alberta Conservation Association. 2010. Reptiles of Alberta. 12 p. Available at http://www.ab-conservation.com/go/default/assets/File/Publications/Brochures/ACA_Reptiles_of_Alberta_WR_2010_v2.pdf,accessed 22 November 2011; Newbold, T.A.S. 2005. Desert horned lizard (*Phrynosoma platyrhinos*) locomotor performance: the influence of cheatgrass (Bromus tectorum). Southwestern Naturalist. 50:17-23; Scholnick, D.A., et al. 2010. Impact of malarial infection on metabolism and thermoregulation in the Fence Lizards *Sceloporus occidentalis* from Oregon. Journal of Herpetology. 44:634-640.

[52] Olson, D.H.; Saenz, D. 2013. Climate Change and Reptiles. (March, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/reptiles/.

[53] Gibbons, J.W. et al. 2000. The global declines of reptiles, Deja vu amphibians. BioScience 50:653-666.

[54] Schriever, T.A. et al. 2009. Effects of hurricanes Ivan, Katrina, and Rita on a southeastern Louisiana herpetofauna. Wetlands. 29:112-122.

[55] Olson, D.H. and Saenz, D. 2013. Climate Change and Reptiles. (March, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/reptiles/.

[56] *Id.*

Climate change causes direct and indirect impacts on birds, including by forcing the use of more energy for thermoregulation, which affects activity levels needed to maintain their condition, reproduction, migration and breeding phenology, all of which can increase mortality.[57] Birds can shift their ranges in response to changing thermal conditions, but such alternative habitat may not be of sufficient quality to meet their needs[58] and the rapid pace of environmental change may exceed the ability of birds to adapt via natural selection.[59] Existing data demonstrate northward and upward shifts in North American bird distributions due to both changes in temperature and precipitation.[60] If shifts in temperature occur more rapidly than birds shift their distribution, then a phonological mismatch can occur, whereby newly arrived birds may not have the food necessary to survive[61] or are forced to occupy marginal habitats, thus contributing to decreased survival and reproduction.[62] Indeed, since plant phenology is directly related to climate change, evidence exists of migratory birds arriving to their summer breeding habitats too late to keep up with the availability of their food supply.[63] For birds shifting their range to higher elevation habitat, there is a finite amount of habitat available before the birds can no long continue to move upwards. Some montane species have moved down in elevation but these species have experienced lower pairing and nesting success due to the marginal habitats occupied.[64] Other indirect effects of climate change include more severe wildfires, which can destroy nests and alter habitat.[65] The spread of disease, including West Nile virus, has been linked to climate change by causing a range contraction in response to drought, thereby exposing birds who use water sources to increased potential for disease transmission via mosquitos.[66]

Unlike plants and many amphibians and reptiles, mammals are more mobile, allowing them to shift their range relatively rapidly if habitat is available.[67] Consequently, the severity of

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[57] Crick, H. Q. P. 2004. The impact of climate change on birds. Ibis. 146:48-56.
[58] Devictor, V. et al. 2008. Birds are tracking climate warming, but not fast enough. Proceedings of the Royal Society B. 275: 2743-2748.
[59] Visser, M.E. 2008. Keeping up with a warming world; assessing the rate of adaptation to climate change. Proceedings of the Royal Society B. 275: 649-659.
[60] Rodenhouse, N. L. et al. 2008. Potential effects of climate change on birds of the Northeast. Mitigation and adaptation strategies for global change 13:517-540; Matthews, S.N. et al. 2011. Changes in potential habitat of 147 North American breeding bird species in response to redistribution of trees and climate following predicted climate change. Ecography. 34: 933-945.
[61] Visser, M.E., Holleman, L.J.M., Gienapp, P. 2006. Shifts in caterpillar biomass phenology due to climate change and its impact on the breeding biology of an insectivorous bird. Oecologia. 147: 164-172; Both, C. and Visser, M.E. 2001. Adjustment to climate change is constrained by arrival date in a long-distance migrant bird. Nature. 411: 296-298.
[62] Crick, H. Q. P. 2004. The impact of climate change on birds. Ibis. 146:48-56.
[63] Both, C., Visser, M.E. 2001. Adjustment to climate change is constrained by arrival date in a long-distance migrant bird. Nature.411: 296-298.
[64] DeLuca, W.V. 2012. Ecology and conservation of the high elevation forest avian community in northeastern North America. Doctoral Dissertation, University of Massachusetts, Amherst.
[65] King, D. and Finch, D.M. 2013. The Effects of Climate Change on Terrestrial Birds of North America. (June, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/birds; Finch, D. M. 2012. Climate change in grasslands, shrublands, and deserts of the interior American West: a review and needs assessment. Gen. Tech. Rep. RMRS-GTR-285. 139 p.
[66] King, D., Finch, D.M. 2013. The Effects of Climate Change on Terrestrial Birds of North America. (June, 2013). U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/birds.
[67] McKelvey, K.S., Perry, R.W., Mills, L.S. 2013. The Effects of Climate Change on Mammals. U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. Available at: www.fs.usda.gov/ccrc/topics/wildlife/mammals.

climate change impacts on most mammals depends on the ability to either adapt in place to the changes or shift their range. The latter strategy is only successful if suitable habitat is available when the shift occurs. If not, then some mammals may be sufficiently adaptable to live in marginal habitat, but only at reduced population numbers and densities, thereby diminishing their role in the ecosystem.[68] Furthermore, given the complexity of the mammalian food web, adverse impacts of climate change on vegetation structure can reduce small mammal abundance, causing cascading impacts throughout the ecosystem.[69] Such perturbations can also adversely affect public health,[70] as mammals can harbor zoonotic disease, which has been clearly documented with the current coronavirus pandemic.[71]

The amount of peer-reviewed, scientific literature assessing the impact of habitat loss, fragmentation, and climate change on a host of species is extensive and provides clear and compelling evidence of these threats to species survival globally and nationally in the United States. From insects to whales and from detritivores to redwoods, every plant and animal species is affected directly, indirectly, or cumulatively by habitat loss, fragmentation, and climate change. While such studies may not involve species currently protected under the ESA, candidate species, or species that may qualify for listing in the future, the impacts of habitat loss, fragmentation, and climate change on domestic and foreign species contained in the literature are nearly entirely universal, affecting virtually every species in some way regardless of its location or level of imperilment.

The proposed and alternate definitions of "habitat" included in the proposed rule are not sufficient to meaningfully respond to the habitat needs of imperiled species in our present state of significant and ongoing environmental change. Finalizing either definition, as written, could be a blueprint for extinction for an untold number of species. The Services must modify the definition to ensure that it covers currently occupied habitat, corridor habitat, and future habitat that a species needs to meet it biological and ecological requirements to survive without imposing any suitability test to define future habitat. Such a change would provide the habitat that imperiled species need to persist and recover now and into the future, thus maximizing the likelihood of species survival and recovery in the face of environmental change and achieving the fundamental goals of the ESA.

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[68] McRae, B.H. et al. 2008. A multi-model framework for simulating wildlife population response to land-use and climate change. Ecological Modelling, 219 (1-2): 77-91.

[69] Thompson, C.M., and Gese, E.M. 2007. Food webs and intraguild predation: community interactions of a native mesocarnivore. Ecology, 88(2): 334-346.

[70] Gubler, D.J. et al. 2001. Climate variability and changes in the United States: Potential impacts on vector- and rodent-borne diseases. Environmental Health Perspectives. 109:223-233; Mills, J.N. et al. 1999. Long-term studies of hantavirus reservoir populations in the southwestern United States: A synthesis. Emerging Infectious Diseases. 5:135-142; Kuenzi, A.J. et al. 2007. Brush mouse (Peromyscus boylii) population dynamics and hantavirus infection during a warm, drought period in southern Arizona. Journal of Wildlife Diseases. 43:675-683; Wilkinson D.A. et al. 2018. Habitat fragmentation, biodiversity loss and the risk of novel infectious disease emergence. J. R. Soc. Interface 15: 20180403. http://dx.doi.org/10.1098/rsif.2018.0403; Doughty, C.E. et al. 2020. Ecography, 43: 1–11, doi: 10.1111/ecog.05209; Johnson, C.K., Hitchens, P.L. et al. 2020. Global shifts in mammalian population trends reveal key predictors of virus spillover risk. Proc. R. Soc. B 287: 20192736. Available at: http://dx.doi.org/10.1098/rspb.2019.2736.

[71] Murdoch, D.R., and French, N.P. 2020. COVID-19: another infectious disease emerging at the animal-human interface. New Zealand Medical Journal Editorial, 133 (1510): 12-14; Ye, Z. et al. 2020. Zoonotic origins of human coronaviruses. International Journal of Biological Sciences, 16(10): 1686-1697.

III. Conclusion

Thank you for your consideration of these comments. If you have any questions or there is any additional information we can provide, please do not hesitate to contact us.

Sincerely,

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