LITIGATING THE CROSSROADS BETWEEN SWEET HOME AND DAUBERT

The world is host to two hundred nations and what amounts to five billion rulers. The strain of catering to so many separate interests is manifest in the flow of political, economic, and social crises. All living things are affected by these crises, but humanity as a species has thus far survived them and prospered. The bounds of human habitability include nearly the whole globe, whereas the entire liveable universe of other species can vanish overnight as one river is dammed or one hillside is laid bare. As we eliminate each species that stands in our way today, we lose any hope of having it back tomorrow. Life on the planet advances irreversibly, like a ratchet, toward greater impoverishment.[1]

INTRODUCTION

As the human population of the earth grows exponentially, so too do our cities, roads, buildings, homes, and material needs. We need more land for development, more water to drink, more food to eat, and more space for play. The more we take for ourselves, the less we leave for Mother Nature and the plants and animals that she encompasses. The human population is growing at an exponential rate and is expected to double in size half-way through the next century.[2] Even though this view is typically associated with environmentalists, biologists, and ecologists, that is not always the case. City planners and land use attorneys have also recognized the severe impact of our actions on the environment.[3]

"Today, human activities seem destined to shape earth's biological future as inexorably as a geological process."[4] Despite increased awareness of the ecological and biological needs of fish and wildlife and the importance of

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1. Les Kaufman, *Why the Ark Is Sinking, in* THE LAST EXTINCTION 1 (Les Kaufman & Kenneth Mallory eds., 2d ed. 1993).

2. *See* Brief of Amici Curiae Scientists at 8, Babbitt v. Sweet Home Chapter of Communities for a Great Or., 515 U.S. 687 (1995) (No. 94-859) [hereinafter Brief of Amici Curiae Scientists].

3. Demographics suggest that by the year 2000:

> [Ninety] percent of all United States citizens will live in urban areas. Urban growth results in the fragmentation and loss of natural wildlife habitat, and the process of urbanization will continue to alter the biological and physical components of existing ecosystems as development reaches into more and more natural areas. . . . The cumulative impact of land development has a devastating impact on natural ecosystems, and that impact extends far beyond the boundaries of developed areas.

CHRISTOPHER J. DUERKSEN ET AL., AM. PLAN. ASS'N., HABITAT PROTECTION PLANNING: WHERE THE WILD THINGS ARE 1 (1997).

4. EDWARD C. WOLF, ON THE BRINK OF EXTINCTION: CONSERVING THE DIVERSITY OF LIFE 37 (Worldwatch Institute Worldwatch Paper 78, 1987).

conserving open space and critical habitats, extinction rates continue to accelerate.[5] The principal causes of extinction continue to be hunting, introduction of foreign predators, and habitat destruction.[6] However, "[i]n the case of living species that are considered by the IUCN [International Union for the Conservation of Nature] to be rare or endangered, human activities account for the rarity of sixty-eight percent of the birds and eighty-six percent of the mammals, with hunting and habitat disruption the principal factors."[7] The importance of species to our way of life and the importance of preserving them is undisputed.[8]

Even though the situation may at first glance appear dismal, all is not lost. The United States Congress has dedicated itself to protecting biodiversity and encouraging conservation with the passage of the Endangered Species Act of 1973 (ESA).[9] With the passage of the ESA, Congress recognized the disturbing impact that humans have on the environment of this country, and subsequently, on the plants and animals that utilize the same resources (air, water, land, trees, etc.).[10] There is little doubt that Congress intended the ESA to afford endangered species the highest of priorities in terms of protection while halting and reversing the trend toward the extinction of wildlife species, no matter how high the cost.[11] Congress even states in the Act itself that "the United States has pledged itself as a sovereign state in the

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5. *See* Richard S. Miller & Daniel B. Botkin, *Endangered Species: Models and Predictions*, 62 AM. SCIENTIST 172, 175 (1974).

6. *See, e.g., id.*

7. *Id.*; *See also* Terry L. Leitzell, *Management Decisions in an Uncertain World*, *in* THE PRESERVATION OF SPECIES: THE VALUE OF BIOLOGICAL DIVERSITY 243 (Bryan G. Norton ed., 1986). "Habitat fragmentation/alteration is thought by many to be the most important single cause of extinction today." *Id.* at 247.

8. *See, e.g.*, ALDO LEOPOLD, A SAND COUNTY ALMANAC (1966); PAUL & ANNE EHRLICH, EXTINCTION: CAUSES AND CONSEQUENCES OF THE DISAPPEARANCE OF SPECIES (1981).

9. Endangered Species Act of 1973, 16 U.S.C. §§ 1531-1544 (1994). The congressionally stated purposes of the ESA are:

> [T]o provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth [by Congress].

Id. § 1531(b).

10. "The Congress finds and declares that ... various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation[.]" *Id.* § 1531(a)(1).

11. *See* Tennessee Valley Auth. v. Hill, 437 U.S. 153 (1978) (illustrating that even though the $100 million Tellico Dam was virtually complete and Congress continued to appropriate large sums of money towards its completion, the Court enjoined any impoundment of the Little Tennessee River, which would eradicate a known population of the snail darter).

international community to conserve to the extent practicable the various species of fish or wildlife and plants facing extinction . . . ."[12]

ESA section 9 prohibits any person[13] from taking any species[14] within the United States or the territorial sea of the United States.[15] "Congress intended to define the term 'take' in the 'broadest possible manner to include every conceivable way' in which a person could take or attempt to take fish or wildlife."[16] Using the broad authority granted by Congress, the U.S. Fish and Wildlife Service (USFWS) promulgated a regulation concerning the meaning

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12. 16 U.S.C. § 1531(a)(4). Congress further states that "these species of fish, wildlife, and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people[.]" *Id.* § 1531(a)(3). It is important to note Congress' definition of conservation:

> [M]ean[ing] to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with *scientific resources management such as research*, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Id. § 1532(3) (emphasis added). "'All methods' sounds definitive. Congress could have said all 'appropriate' methods, or 'all methods except those that involve the regulation of habitat on nonfederal lands,' but it did not. It said 'all methods.'" Brief of Amici Curiae Scientists, *supra* note 2, at 22.

13. Under the ESA, it is evident that Congress has gone to great lengths to insure that everyone is subject to the section 9 taking prohibitions:

> The term "person" means an individual, corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the Federal Government, of any State, municipality, or political subdivision of a State, or of any foreign government; any State, municipality, or political subdivision of a State; or any other entity subject to the jurisdiction of the United States.

16 U.S.C. § 1532(13).

14. "The term 'species' [under the ESA] includes any subspecies of fish or wildlife or plants, *and any distinct population segment of any species* of vertebrate fish or wildlife which interbreeds when mature." *Id.* § 1532(16) (emphasis added). It is important to note at the outset that Congress has specifically declared that species' populations are to be afforded the same protections as to individual members of the population. "[I]t is the viability of the *species* that is of vital importance." Brief of Amici Curiae Scientists, *supra* note 2, at 24 (emphasis added). *See also*, Robert D. Thornton, *Takings Under Endangered Species Act Section 9*, 4 NAT. RESOURCES & ENV'T 8 (1990).

15. *See* 16 U.S.C. § 1538(a)(1)(B). The ESA defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." *Id.* § 1532(19).

16. James C. Kilbourne, *The Endangered Species Act Under the Microscope: A Closer Look from a Litigator's Perspective*, 21 ENVTL. L. 499, 573 (1991) (citing S. REP. NO. 307, at 1 (1973), *reprinted in* 1973 U.S.C.C.A.N. 2989, 2995). *But see* Frederico M. Cheever, *An Introduction to the Prohibition Against Takings in Section 9 of the Endangered Species Act of 1973: Learning to Live with a Powerful Species Preservation Law*, 62 U. COLO. L. REV. 109 (1991) (noting that the ESA is not perfect in protecting biodiversity unless that biodiversity is already in danger of extinction). "The Act does not make it illegal to exploit a 'healthy' species population beyond that species' ability to sustain exploitation or to destroy or degrade the habitat of a healthy species until that destruction drives the species to the verge of extinction." *Id.* at 119.

of "harm" in the take definition.[17] The Supreme Court held this definition of harm to include "significant habitat modification or degradation that actually kills or injures wildlife."[18] The takings prohibition applies *only* to those species that have been designated by the USFWS as being threatened or endangered.[19]

Perhaps the single most important aspect of the ESA to the environmental community is the citizen suit provision which states in pertinent part, "[a]ny person may commence a civil suit on his own behalf . . . to enjoin any person, including the United States and any other governmental instrumentality or agency . . . who is alleged to be in violation of any provision . . . or regulation issued under the authority thereof."[20] The importance of this provision is two-fold; it allows citizens to insure that both citizens *and* federal agencies are in compliance with the ESA. The citizen suit provision becomes even more important as one begins to understand how far the takings prohibition extends into our way of life.

As of April 30, 1998, there were 902 plants and animals on the Endangered Species list in the United States alone.[21] In addition, there were 233 threatened plants and animals.[22] In all, there were 1135 plants and animals in the United States[23] listed by the U.S. Fish and Wildlife Service under the ESA as being "in danger of extinction throughout all or a significant portion of its range."[24] Currently, another 3000 to 4000 species are under consideration for listing.[25] These statistics are even more astounding when one considers that nearly half of all listed species are known to exist only on nonfederal lands.[26] "Most recently . . . more than ninety percent of listed species have some or all of their habitat on nonfederal lands, and thirty-four percent of suitable habitat for listed species is found *entirely* on nonfederal lands."[27]

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17. *See* 50 C.F.R. § 17.3 (1997). Harm "means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." *Id.*

18. Babbitt v. Sweet Home Chapter of Communities for a Great Or., 515 U.S. 687, 708 (1995).

19. *See generally* 50 C.F.R. § 17.11 (1997) (current listing of threatened and endangered species).

20. 16 U.S.C. § 1540(g)(1)(A).

21. *See Endangered Species Bulletin* (U.S. Fish and Wildlife Serv., Washington, D.C.) Mar./June, 1998, at 44.

22. *See id.*

23. *See id.*

24. 16 U.S.C. § 1532(6). The ESA defines threatened species as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." *Id.* § 1532(20).

25. *See* Brief of Amici Curiae Scientists, *supra* note 2, at 13.

26. *See id.* at 6.

27. *Id.* at 18

Habitat loss continues to be the primary problem confronting endangered and threatened plants and animals.[28] Even Congress has recognized that one of the major causes of extinction is destruction of species' habitats.[29] "The increased rate of habitat loss is the result of physical, chemical, and biological perturbations, all resulting from human activities."[30] As the reaches of science begin to help us understand how our actions affect the world around us, the ESA may start to focus more on science, instead of law. "[W]ith the growing focus on concepts of conservation biology, biodiversity, and ecosystem management, administration of the ESA has increasingly turned to the conservation and management of multiple species and habitats as a common denominator."[31] Writing as Amici for the Supreme Court in *Babbitt v. Sweet Home Chapter of Communities for a Great Oregon*, several well-known and respected scientists, including John Cairns, Jr., Stephen Jay Gould, Ernst Mayr, Daniel Simberloff, and Edward O. Wilson, stated in their brief:

> There is no other law like the ESA. No law so boldly states the commitment to respect all forms of life, and strives to understand the human role in evolution. If the ESA does not protect habitat, wherever it be found, then it does not protect species, and it cannot succeed.[32]

In terms of defending endangered species from habitat loss, the problem for scientists is the law, while the problem for lawyers is the science. In order to effectively protect endangered species' habitats from destruction or adverse modification, the lawyers and scientists must work together, both inside and outside of the courtroom. As scientists begin to better understand concepts such as habitat fragmentation, edge effects, and the effects of pollution,[33]

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28. *See, e.g.*, Leitzell, *supra* note 7, at 247-48. *See also* Brief of Amici Curiae Scientists, *supra* note 2, at 5 (arguing that habitat loss is *the* major cause of extinction).

29. Representative Sullivan, the House floor manager for the ESA stated:

> For the most part, the principal threat to animals stems from destruction of their habitat. The destruction may be intentional, as would be the case in clearing of fields and forests for development of resource extraction, or it may be unintentional, as in the case of the spread of pesticides beyond their target area. Whether it is intentional or not, however, the result is unfortunate for the species of animals that depend on that habitat, most of whom are already living on the edge of survival.

119 CONG. REC. H30,162 (daily ed. Sept. 18, 1973) (statement of Rep. Sullivan) (quoted in part in Babbitt v. Sweet Home Chapter of Communities for a Great Or., 515 U.S. 687, 706 n.19 (1995)).

30. *See* James D. Williams & Ronald M. Nowak, *Vanishing Species in Our Own Backyard, in* THE LAST EXTINCTION, 115, 148 (Les Kaufman & Kenneth Mallory eds., 2d ed. 1993).

31. Murray D. Feldman & Michael J. Brennan, *Judicial Application of the Endangered Species Act and the Implications for Takings of Protected Species and Private Property*, 32 LAND & WATER L. REV. 509, 510 (1997).

32. Brief of Amici Curiae Scientists, *supra* note 2, at 7.

33. For further discussion of these concepts, *see infra* Part II.

lawyers can better use these concepts to protect endangered species from the threats of habitat modifications.

This Note addresses the evidentiary problems that have arisen after *Sweet Home* in terms of proving, via scientific evidence, a habitat modification sufficient enough to prove a "taking" under the ESA.[34] This issue is further complicated by the Supreme Court's 1993 holding in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, which redefined the standard for admitting expert scientific evidence and testimony in a federal trial.[35] Part I provides a background of the USFWS's "harm" regulation and the *Sweet Home* and *Daubert* decisions. Part II addresses the sufficiency of certain kinds of scientific evidence to prove a habitat modification significant enough to constitute a take under the ESA. The Note concludes with a consideration of the implications of the *Sweet Home* decision and its subsequent effect on future litigation attempting to protect habitats of endangered/threatened species.

I. BACKGROUND

> *The law locks up both man and woman who steals [sic] the goose from the common, but lets the greater felon loose who steals the common from the goose.*[36]

A. U.S. Fish and Wildlife Service's Definition of Harm

In order to meet its duty of proper implementation of the ESA, the USFWS promulgated the definition of harm in 1975.[37] That definition stated:

> "Harm" in the definition of "take" in the Act means an act or omission which actually injures or kills wildlife, including acts which annoy it to such an extent as to significantly disrupt essential behavioral patterns, which include, but are not limited to, breeding, feeding or sheltering; *significant environmental modification or degradation which has such effects is included within the meaning of "harm."*[38]

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34. Babbitt v. Sweet Home Chapter of Communities for a Great Or., 515 U.S. 687 (1995).

35. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 597 (1993).

36. Brief of Amici Curiae Scientists, *supra* note 2, at 21 (citations omitted).

37. *See* Endangered and Threatened Wildlife and Plants: Reclassification of American Alligator and Other Amendments, 40 Fed. Reg. 44,412, 44,416 (1975) (to be codified at 50 C.F.R. § 17.3) [hereinafter Reclassification].

38. *Id.* (emphasis added).

The original definition made it clear that prohibitions on habitat modifications were limited only to those acts or omissions causing actual (as opposed to potential) death or injury to endangered species of fish or wildlife.[39] The regulation noted that "[t]he actual consequences of such an action upon a listed species is paramount."[40] The USFWS went further to discuss the limitations of the rule on landowners wishing to modify their landscape in a manner that may be detrimental to endangered species, stating:

> It should be noted that this definition of "harm" which includes significant environmental modification, does not permanently limit the environmental modifications that are permissible for the habitat of a listed species of fish or wildlife. If the species was originally classified as endangered and made a significant recovery, it could be down-listed to threatened with regulations that don't prohibit "takings." Second, the species could recover completely and be delisted altogether. Finally, the species in question could abandon its use of the area. In all of these situations, the limited restrictions on environmental modification under the definition of "harm" would be removed.[41]

After the promulgation of this rule, the USFWS was eventually persuaded that the definition of "harm" needed to be redefined to avoid any ambiguity as to its actual meaning.[42] In a memo from the Solicitor General's office to the Director of the USFWS, the Solicitor expressed the ambiguity regarding "harm," stating that:

> If the words "such effects" are read to refer to the phrase "significantly disrupt essential behavioral patterns," then any significant environmental modification or degradation that disrupts essential behavior patterns will fall under the definition of harm, regardless of whether an actual killing or injuring of wildlife is demonstrated. Under such an interpretation a showing of habitat modification *alone* would be sufficient to invoke the criminal penalties of Section 9. . . . [S]uch a result is inconsistent with the intent of Congress.[43]

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39. *See* Reclassification, 40 Fed. Reg. at 44,413.

40. *Id.*

41. *Id.*

42. *See* Endangered and Threatened Wildlife and Plants; Final Redefinition of "Harm," 46 Fed. Reg. 54,748 (1981) (to be codified at 50 C.F.R. § 17.3).

43. Memorandum from the Associate Solicitor, Conservation and Wildlife, to the Director, Fish and Wildlife Service 2 (Apr. 17, 1981), *reprinted in* U.S. FISH AND WILDLIFE SERVICE, DRAFT

The memo from the Solicitor General demonstrated the ambiguous interpretation of the definition of harm from a recent case decided by the Ninth Circuit Court of Appeals.[44] In *Palila v. Hawaii Department of Land and Natural Resources*, the Sierra Club sought to enjoin the Hawaii Department of Land and Natural Resources from maintaining populations of feral sheep and goats in the critical habitat of the Palila, an endangered bird.[45] The court found that the feral sheep and goats were consuming seedlings and shoots of the mamane forest, which are essential for the Palila's survival.[46] "By consuming seedlings and shoots, the animals prevent regeneration of the forest, and thus bring about the relentless decline of the Palila's habitat."[47] However, despite evidence that the Palila population had in fact increased, the court held that the habitat modifications alone were sufficient for a "take," even though no evidence of the killing or injuring of individual Palilas was introduced.[48]

In direct response to the Solicitor General's memorandum and the holding from *Palila I*, the USFWS redefined the term "harm."[49] The USFWS explained its decision for the redefinition:

> "Harm" is redefined to mean any action, including habitat modification, which actually kills or injures wildlife, *rather than the present interpretation which might be read to include habitat modification or degradation alone without further proof of death or injury.* Habitat modification as injury would only be covered by the new definition if it significantly impaired essential behavioral patterns of a listed species.[50]

The USFWS and the Solicitor General were particularly concerned that subsequent litigation would foster an interpretation of the original definition as providing for a section 9 taking without showing any actual death or injury to the species.[51] The new definition requires a "factual connection" between

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ENDANGERED SPECIES CONSULTATION HANDBOOK: PROCEDURES FOR CONDUCTING SECTION 7 CONSULTATIONS AND CONFERENCES at 307 (1994) [hereinafter Memorandum].

44. *See id.* at 7-8 (citing to Palila v. Hawaii Dep't of Land and Natural Resources ("Palila I"), 471 F. Supp. 985 (D. Haw. 1979), *aff'd*, 639 F.2d 495 (9th Cir. 1981)).

45. *See Palila I*, 471 F. Supp. at 987.

46. *See id.* at 989-90. "The mamane trees provide food, shelter and nest sites for the Palila." *Id.* at 989.

47. *Id.* at 990.

48. *See* Memorandum, *supra* note 43, at 7-8 (citing *Palila I*, 471 F. Supp. at 988 n.2, 995).

49. *See* 50 C.F.R. § 17.3 (1997).

50. Endangered and Threatened Wildlife and Plants; Final Redefinition of "Harm," 46 Fed. Reg. 54,748 (1981) (to be codified at 50 C.F.R. § 17.3) (emphasis added).

51. *See id.*

the land use and the prohibited impact.[52] The facts necessary to show the critical link between the land use activity and the impact are not fully understood, but the USFWS has provided some insight into the regulation:

> Identifying habitat modifications that harm individuals of a species involves understanding the species' life history. For example, the Florida scrub jay is highly territorial and relies for its existence on food cached within its territory. A project that destroys occupied habitat and thus the food supply for that family group is likely to result in their starvation. Similarly, a number of birds are highly site-tenacious, returning year after year to the same nesting site. Removal of nesting habitat on that site is likely to result in loss of the pair's reproductive capability, and may result in loss of the pair for lack of available feeding or nesting habitat. Opening up or fragmenting the habitat may similarly affect the species by introducing increased predation or parasitism.[53]

The original definition of "harm" was not challenged in *Palila I* as exceeding USFWS's statutory authority;[54] the new definition was not challenged on that ground until *Sweet Home*.[55]

B. Babbitt v. Sweet Home Chapter of Communities for a Great Oregon

At issue in *Sweet Home* was the USFWS's definition of "harm" within the meaning of "take." That definition included the phrase "significant habitat modification or degradation that actually kills or injures wildlife."[56] The facial challenge was brought by several small landowners, logging companies, and families dependent upon the timber industry in the Pacific Northwest and the Southeast.[57] The plaintiffs alleged that they possessed the requisite legal standing to bring the suit because application of the harm definition to species of red-cockaded woodpecker, an endangered species, and the northern spotted

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52. *See* Andrew J. Doyle, Note, *Sharing Home Sweet Home with Federally Protected Wildlife*, 25 STETSON L. REV. 889, 900 (1996). "Courts call this connection the 'critical link between habitat modification and injury.'" *Id.*

53. Albert Gidari, *The Economy of Nature, Private Property, and the Endangered Species Act*, 6 FORDHAM ENVTL. L.J. 661, 674 (1995) (citing U.S. FISH AND WILDLIFE SERVICE, DRAFT ENDANGERED SPECIES CONSULTATION HANDBOOK: PROCEDURES FOR CONDUCTING SECTION 7 CONSULTATIONS AND CONFERENCES 4-43 (1994)).

54. *See* Memorandum, *supra* note 43, at 8.

55. *See* Babbitt v. Sweet Home Chapter of Communities for a Great Or., 515 U.S. 687, 690 (1995) (determining whether the Secretary exceeded his authority under the ESA by promulgating the "harm" regulation).

56. *Id.*

57. *See id.* at 692.

owl, a threatened species, injured them economically.[58] The Supreme Court upheld the regulation as a reasonable interpretation of Congress' intent regarding the meaning of "take" under the ESA.[59]

The Court upheld the regulation for three reasons. First, the USFWS's interpretation was supported by ordinary understanding of the word "harm."[60] The Court found the dictionary definition of the word harm to mean to cause hurt, damage, or injury.[61] In the context of the ESA, the Court concluded that the definition naturally encompasses habitat modification that results in actual injury or death to members of an endangered or threatened species.[62]

Second, the Court found that the broad purpose of the ESA supported the Secretary's decision to extend protection against activities that cause the precise harms Congress sought to avoid.[63] The Court relied upon its previous holding in *Tennessee Valley Authority v. Hill* that Congress' clear expression of the ESA's broad purpose to protect endangered and threatened wildlife supported the Secretary's definition of harm as reasonable.[64] In *TVA*, the Court held that the ESA was "the most comprehensive legislation for the preservation of endangered species ever enacted by any nation."[65]

Third, the Court relied upon the legislative history of the ESA to conclude that Congress intended that the "take" prohibitions apply broadly to cover indirect as well as purposeful (direct) actions.[66] The Court relied upon several Senate and House reports, as well as several hearings before congressional committees, to conclude that "take" was to be defined in the broadest possible sense to include many ways that a person can "take" wildlife.[67]

The problem after *Sweet Home* is the ambiguity of the Court's holding regarding the proof of causation of a habitat modification that is sufficient to warrant a "take" violation. The Court never explicitly stated in its opinion what evidence would be necessary to show that such a "take" has occurred. Justice O'Connor's concurring opinion mentioned causation and stated that "the 'harm' regulation applies where significant habitat modification, by

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58. *See id.*
59. *See id.* at 708.
60. *See id.* at 697.
61. *See id.*
62. *See id.*
63. *See id.* at 698.
64. *See id.* at 698-700 (citing Tennessee Valley Auth. v. Hill, 437 U.S. 153, 184 (1978)). The plain intent of enacting this statute "was to halt and reverse the trend toward species extinction, whatever the cost. This is reflected not only in the stated policies of the Act, but in literally every section of the statute." *Id.* at 699.
65. *Id.* at 698 (citing *Tennessee Valley Auth.*, 437 U.S. at 180).
66. *See id.* at 704-08.
67. *See id.*

impairing essential behaviors, proximately (foreseeably) causes actual death or injury to identifiable animals that are protected under the Endangered Species Act."[68] Justice O'Connor and the Court basically left it to the lower courts to decide the extent of the proximate cause and foreseeability of a particular activity.[69] The word meaning of the word "actually" in the language of the regulation ("which actually kills or injures wildlife") should generate considerable debate in subsequent litigation.

The Department of the Interior amended the regulation in 1981 to include the term "actually" to preclude claims of a section 9 taking for habitat modification alone without any attendant death or injury of the protected wildlife.[70] Commentators seem convinced that the term "actually" prevents litigation concerning harm that is hypothetical or conjectural, as opposed to harm that is concrete and particularized.[71] It also seems established that the term "actual harm" cannot be applied to a future generation of species, or to show that an activity that is preventing a potential species from being born is a sufficient injury to a species' breeding capability.[72] Nonetheless, the Supreme Court's holding leaves very little guidance to the lower courts on determining liability for habitat-altering activities and the specific application of the ESA section 9 prohibitions.

In his dissent, Justice Scalia argued that no injury to a species' breeding capability is possible because it does not result in actual injury to the specific species.[73] Justice Scalia further explained that the majority was blatantly reading the statute wrongly, stating that the language obviously removes proximate causation as a requirement, and instead requires something akin to direct, or but-for causation.[74] It is unclear if Justice Scalia's logic will have

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68. *Id.* at 713 (O'Connor, J., concurring).

69. *See* Tara L. Mueller, *Babbitt v. Sweet Home Chapter of Communities: When is Habitat Modification a Take?*, 3 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 333, 338 (1996). Mueller states that:

> [W]hat is and is not a 'proximate cause' of a particular activity is in the eye of the beholder . . . . [and] whether the adverse effects of habitat modification on a given species are deemed to be "foreseeable" will depend upon the judge's scientific understanding of the direct relationship between species survival and habitat preservation, and whether the judge believes that a reasonable person may be charged with constructive knowledge of this relationship, both in the abstract and in the context of a particular case.

Id.

70. *See* Endangered and Threatened Wildlife and Plants; Final Redefinition of "Harm," 46 Fed. Reg. 54,748 (1981) (to be codified at 50 C.F.R. § 17.3).

71. *See, e.g.*, Duane J. Desiderio, *Sweet Home on the Range: A Model for As-Applied Challenges to the "Harm" Regulation*, 3 ENVTL. L. 725, 809 (1997).

72. *See id.*

73. *See Sweet Home*, 515 U.S. at 734 (Scalia, J., dissenting).

74. *See id.* at 733.

any impact on the lower courts' analysis of these issues. Only time will tell exactly what is required by the ESA to prove a habitat modification.

Courts have not construed the term "actually" to mean that claims of illegal habitat modifications cannot be made until after endangered species are actually found dead, but rather so long as a reasonably certain threat of imminent harm to a protected species exists, such a claim can be made.[75] Courts thus far appear content that the term "actually" refers to the "degree of certainty that harm would befall" an endangered species as opposed to the "timing of the injury."[76] Since it is evident that the courts are willing to extend *Sweet Home* to threats of future harm with the requisite showing of proximate harm and foreseeability, the federal evidentiary standards must be examined to determine to what extent evidence is necessary to show such harm to an endangered species. *Daubert* provides such insight.

C. Daubert v. Merrell Dow Pharmaceuticals, Inc.

In *Daubert*, the Supreme Court interpreted the rules regarding the standards of admissibility of scientific evidence, in particular those under Rule 702 of the Federal Rules of Evidence.[77] The plaintiffs in the case were two children born with serious birth defects.[78] The plaintiffs alleged that their birth defects were caused by their mothers' ingestion of Bendectin, a prescription antinausea drug marketed by the defendant drug company.[79] Faced with an inevitable "battle of the experts,"[80] the district court granted

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75. *See* Marbled Murrelet v. Babbitt, 83 F.3d 1060, 1064 (9th Cir. 1996); *See also* Forest Conservation Council v. Rosboro Lumber, 50 F.3d 781 (9th Cir. 1995) (holding that threat must be imminent, not potential or mere speculation); National Wildlife Fed'n v. Burlington N. R.R., 23 F.3d 1508 (9th Cir. 1995) (requiring showing of significant impairment of species breeding, feeding habits and proof that habitat degradation prevents, or possibly, retards, recovery of the species.); Hawksbill Sea Turtle v. Federal Emergency Management Agency, 11 F. Supp. 2d. 529 (D.V.I. 1998) (requiring proof that: (1) endangered/threatened species actually exist and are found on the site where modification is to take place, and (2) a factual basis on which to establish the requisite causal link between modification and factors theorized to pose a risk).

76. *Forest Conservation Council*, 50 F.3d at 785. The court also stated that "[s]o long as some injury to wildlife occurs, either in the past, present, or future, the injury requirement of the Secretary's new definition would be satisfied." *Id.* at 784.

77. Rule 702 states: "If *scientific*, technical, or other specialized *knowledge* will *assist the trier of fact to understand the evidence or to determine a fact in issue*, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise." FED. R. EVID. 702. (emphasis added).

78. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 582 (1993).

79. *See id.*

80. *See id.* The defendants submitted affidavits of a well-credentialed expert who concluded that maternal use of Bendectin during the first trimester of pregnancy had not shown to be a risk factor for human birth defects. Plaintiffs, on the other hand, with the aid of eight experts of their own, concluded that Bendectin could cause birth defects. The Supreme Court stated with regard to plaintiffs' experts:

defendant's motion for summary judgment, stating that "scientific evidence is admissible only if the principle upon which it is based is 'sufficiently established to have general acceptance in the field to which it belongs.'"[81] Both the district court and the court of appeals based their decision to grant defendant's motion for summary judgment upon *Frye v. United States*,[82] which held that "expert opinion based on a scientific technique is inadmissible unless the technique is 'generally accepted' as reliable in the relevant scientific community."[83]

The Supreme Court granted certiorari in *Daubert* because of the split among the circuit courts regarding the proper standard for the admission of expert scientific testimony.[84] In effect, the Court repealed the former *Frye* standard as a necessary precondition to admissibility of scientific evidence.[85] The Court reasoned that the liberal Federal Rules of Evidence superseded the former *Frye* standard of "general acceptance" and instituted a relaxation of the traditional barriers to opinion testimony.[86] As a result, the Court concluded that the Rules assign to the trial judge the task of ensuring that the expert's testimony and/or evidence both rests on a reliable foundation and is relevant to the pending issue.[87]

The trial judge retains the role as a "gate-keeper" of scientific evidence to insure that "[t]he subject of an expert's testimony must be 'scientific . . . knowledge'" that rests on a reliable foundation, as required by Rule 702.[88] Matters that are considered "scientific" indicate that the material has been formulated from the methods and procedures of science.[89] The Court found that the word "knowledge" connotes more than subjective belief or unsupported speculation. The term "applies to any body of known facts or to any body of ideas inferred from such facts or accepted as truths on good grounds."[90] Basically, the Court developed a standard of evidentiary

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Their conclusions were based upon "in vitro" (test tube) and "in vivo" (live) animal studies that found a link between Bendectin and malformations; pharmacological studies of the chemical structure of Bendectin that purported to show similarities between the structure of the drug and that of other substances shown to cause birth defects; and the "reanalysis" of previously published epidemiological (human statistical) studies.

Id. at 583.

81. *Id.* (citing Daubert v. Merrell Dow Pharm., Inc., 727 F. Supp. 570, 572 (S.D. Cal. 1989)).
82. Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).
83. *Daubert*, 509 U.S. at 584 (citing *Frye*, 293 F. at 1014).
84. *See id.* at 585.
85. *See id.* at 587.
86. *See id.*
87. *See id.* at 589-90.
88. *Id.*
89. *See id.* at 590.
90. *Id.* (quoting WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 1252 (1986)).

reliability, or trustworthiness, to insure that an expert's opinion pertains to "scientific knowledge."[91] "In a case involving scientific evidence, evidentiary reliability will be based upon scientific validity."[92] Therefore, after *Daubert*, the focus of the inquiry is no longer whether a proffered scientific theory is "generally accepted" in the scientific community, but rather whether the methods and procedures involved in the development of the scientific theory are scientifically valid, and hence more reliable for use in a court of law. It is not difficult for one to imagine a scientific theory that is generally accepted among the scientific community but found to be inadmissible in a court of law due to its lack of reliability.[93]

Rule 702 further requires that the scientific evidence/testimony "assist the trier of fact to understand the evidence or to determine a fact in issue."[94] This requirement goes to the relevancy of the evidence.[95] Since the number of variables involved with scientific evidence can at times seem limitless, relevancy of certain scientific evidence is sure to play a larger role in future litigation. Having sensed this, the Court put forth a simple, yet ambiguous, test to determine relevancy: "whether expert testimony proffered in the case is sufficiently tied to the facts of the case that it will aid the jury in resolving a factual dispute."[96] It is still unknown how broadly or narrowly courts will interpret "sufficiently" when determining relevancy of evidence.[97]

In *Daubert*, the Supreme Court laid out a basic preliminary test for trial judges to determine whether scientific expert testimony should be admitted as evidence in trial.[98] The Court presented some "general observations"

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91. *Id.*

92. *Id.* at 590 n.9.

93. *See, e.g.*, Sierra Club v. Marita, 843 F. Supp. 1526, (E.D. Wis. 1994) *aff'd*, 46 F.3d 606 (7th Cir. 1995) (holding that Forest Service did not err in failing to consider principles of conservation biology in fulfilling requirement of biological diversity).

94. FED. R. EVID. 702.

95. "'Relevant evidence' means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence." FED. R. EVID. 401. "All relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by Act of Congress, by these rules, or by other rules prescribed by the Supreme Court pursuant to statutory authority. Evidence which is not relevant is not admissible." FED. R. EVID. 402.

96. *Daubert*, 509 U.S. at 591 (quoting United States v. Downing, 753 F.2d 1224, 1242 (3d Cir. 1985)).

97. It is important to note that all the federal rules relied upon in this Note, and by the Court in *Daubert*, apply only to cases or controversies arising in federal court. States often have adopted rules of evidence similar to the federal rules; however, differences arise in interpretation and application between states and even between federal circuits as well. A study of *Daubert* alone should not be the end point of a litigator's search for the law.

98. It is essential to note that the Court qualifies its own test right from the outset by stating that "[m]any factors will bear on the inquiry, and we do not presume to set out a definitive checklist or test." *Daubert*, 509 U.S. at 593. The items in the text that follow are "general observations" that the Court felt

regarding the typical information trial judges should seek when determining the evidentiary reliability of the evidence.[99] In particular, the court should determine whether: 1) the theory can be (and has been) tested for falsifiability or refutability;[100] 2) the theory has been subjected to peer review and publication (publication is not *sine qua non* of admissibility);[101] 3) there is any known rate or potential for error, and the "existence and maintenance of standards controlling the technique's operation;"[102] and 4) there is an "explicit identification of a relevant scientific community and an express determination of a particular degree of acceptance within that community."[103] Perhaps the most important piece of the explanation of the general standards of admissibility for scientific evidence (and how they differ from *Frye's* general acceptance test) is the following statement by the Court: "The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate."[104] Even though the Court seems to adopt the *Frye* standard as part of the *Daubert* test, general acceptance is now only a small piece of the puzzle that must be solved prior to admissibility.

The *Daubert* standard is the overriding standard governing the introduction of evidence concerning habitat modification and degradation. Even though the standard seems firmly set, it by no means removes the responsibility of a judge as the "gatekeeper" in screening such evidence.[105] If a judge determines that the evidence is inadmissible, the ruling is subject only to an abuse of discretion standard, which is difficult to overturn on appeal.[106]

After *General Electric Co. v. Joiner*, a plaintiff in litigation must ensure that he has the proper evidence and experts to pass the *Daubert* standard and must get the evidence of habitat modification introduced to the trier of fact. Part II explores those evidentiary options further.

II. USING SCIENCE TO MEET *SWEET HOME* AND *DAUBERT* STANDARDS TO PROVE HABITAT MODIFICATIONS

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were pertinent to an inquiry regarding scientific testimony, but are not *sine qua non* of admissibility. *See id.*

99. *See id.* at 593-94.
100. *See id.* at 593.
101. *See id.*
102. *Id.* at 594.
103. *Id.* (quoting United States v. Downing, 753 F.2d 1224, 1238 (3d Cir. 1985)).
104. *Id.* at 595.
105. *See* General Elec. Co. v. Joiner, 118 S. Ct. 512, 517 (1997).
106. *See id.*

> *We poison the caddis flies in a stream and the salmon runs dwindle and die. We poison the gnats in a lake and the poison travels from link to link of the food chain and soon the birds of the lake margins become its victims . . . . These are matters of record, observable, part of the world around us. They reflect the web of life-or death-that scientists call ecology.*[107]

After the Supreme Court's decisions in *Sweet Home* and *Daubert*, questions still remain as to the types and quantum of scientific evidence that are required to prove a "taking" by habitat modification. Most recently, the issue has come full circle in a Ninth Circuit Court of Appeals case that deals with the endangered ferruginous pygmy-owl.[108] Despite the district court's finding that the plaintiffs' experts were the "most knowledgeable authorities on pygmy owls," the court still found their testimony, that massive construction activities would "harm" the few remaining pygmy-owls, inadequate to support a section 9 taking claim.[109] The *Defenders of Wildlife v. Bernal* case illustrates the immediate importance of determining not only what types of science a district court judge will accept as a given "fact," but also how much of those "scientific facts" are required to convince a trier of fact that a habitat modification is adversely affecting an endangered species of wildlife.

It is important to begin this analysis with a basic understanding of science, ecology, and biodiversity. One commentator offers an excellent explanation of scientific thinking:

> Most characteristic of scientific thinking is its demand for verification—its habit of cultivated skepticism. Science disproves; it does not prove. Alternative hypotheses are proposed to explain given phenomena which are then tested. Disproved hypotheses are discarded, and the hypothesis that was not disproved is held to explain the phenomenon. This hypothesis then becomes the "theory" explaining the phenomenon, and it is subject to rejection in the future should new evidence disprove it. Science's habit of cultivated skepticism extends to established scientific views as well as new ones. This is one of science's most important characteristics. Established views are always subject to rejection should they eventually be disproven.[110]

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107. ALSTON CHASE, IN A DARK WOOD 1 (1995) (citing RACHEL CARSON, SILENT SPRING 169-70 (1962)) (emphasis omitted).

108. *See* Appellant's Opening Brief at 32-33, Defenders of Wildlife v. Bernal (9th Cir. filed July 27, 1998) (No. 98-16099).

109. *Id.*

110. Patricia Smith King, *Applying* Daubert *to the "Hard Look" Requirement of NEPA: Scientific*

It is also important to note that scientific theories are not guesses, but rather the culmination of the best available explanations after thorough testing and elimination of alternatives.[111] "[S]cientific theories are the 'facts' of science."[112] It is essential for litigators and judges alike to recognize that there are no certainties in science, and that the explanations offered are not usually arbitrary or untested.[113]

This section will introduce certain ecological principles that should be the underlying scientific basis for plaintiffs to introduce evidence of habitat modifications in court. These principles are viewed in the abstract and are not directed toward any particular species. They are presented to give members of the legal profession a brief introduction to some principles that should be admissible under *Daubert* as "scientific theories" to which experts can apply specific facts during their testimony in a given case.

The three principles outlined below are products of the disciplines of ecology and conservation biology. "Ecology, defined most simply and in its broadest sense, is the study of the interrelationships of organisms and the environment."[114] Conservation biology, as opposed to ecology, is a recent edition to the disciplines of science, dating back only to the 1980s.[115]

> It is a new, synthetic field that applies the principles of ecology, biogeography, population genetics, economics, sociology, anthropology, philosophy, and other theoretically based disciplines to the maintenance of biological diversity . . . . It is synthetic in that it unites traditionally academic disciplines such as population biology and genetics with the applied traditions of game and forest management and allied fields.[116]

Because of its recent birth into the sciences, some courts have been unwilling to abide by conservation biology principles in their holdings.[117] This unwillingness to acknowledge the principles of conservation biology may be overcome by new scientific knowledge regarding habitat modification and

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Evidence Before the Forest Service in Sierra Club v. Marita, 2 WIS. ENVTL. L.J. 147, 151 (1995) (citation omitted).

111. *See id.*

112. *Id.*

113. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 590 (1993).

114. ROBERT LEO SMITH, ELEMENTS OF ECOLOGY 8 (3d ed. 1992).

115. *See* GARY K. MEFFE & C. RONALD CARROLL, PRINCIPLES OF CONSERVATION BIOLOGY 4 (1994).

116. *Id.*

117. *See* Sierra Club v. Marita, 843 F. Supp. 1526 (E.D. Wis. 1994), *aff'd*, 46 F.3d 606 (7th Cir. 1995) (holding that Forest Service did not err in failing to consider principles of conservation biology in fulfilling requirement of biological diversity).

edge effects that have been recognized by some courts. This new knowledge provides a basis to meet the *Daubert* scientific theory requirement.

To begin any challenge under section 9 of the ESA regarding "harm," it is universally required that plaintiffs first prove that the endangered species is *currently present* on the property in dispute, and within the area of the modification/alteration.[118] Courts are very consistent in this requirement.[119]

A. Habitat Fragmentation

> Habitat fragmentation is the process whereby a large, continuous area of habitat is both reduced in area and divided into two or more fragments. When habitat is destroyed, there is often a patchwork of habitat fragments left behind. These fragments of the original habitat are often isolated from one another by a highly modified or degraded landscape.[120]

Fragmentation usually occurs with a severe reduction in habitat area, but can also occur in situations where habitat area is reduced only minimally from such intrusions as roads, railroads, canals, power lines, fences, fire lanes, or other obstacles that provide a barrier to free movement of a species.[121] Fragmentation forces species to maintain their populations in limited habitats.[122]

Habitat fragmentation, alone or in combination with other factors, has the ability to significantly impact the breeding, feeding, or sheltering behavior of a species.[123] Most significantly, habitat fragmentation creates barriers to normal dispersal and colonization processes.[124] Species that require large parcels of habitat or species that are food specialists (limited to certain specific kinds of food) tend to be most affected.[125] Depending upon the species, many birds, mammals, and even insects will not cross small distances

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118. *See, e.g.*, Morrill v. Lujan, 802 F. Supp. 424, 430 (S.D. Ala. 1992) (granting defendant's motion for summary judgment due to a lack of evidence that the presidio beach mouse ever existed on property in question).

119. *See, e.g.*, Coastside Habitat Coalition v. Prime Properties, Inc., No. C 97-4025 CRB, 1998 WL 231024, at *2 (N.D. Cal. Apr. 30, 1998) (holding that plaintiffs failed to establish that any San Francisco garter snakes occupied defendant's property); Hawksbill Sea Turtle v. Federal Emergency Management Agency, 11 F. Supp. 2d 529, 552-54 (D.V.I. 1998) (holding that plaintiffs provided no direct evidence that Tree Boas would utilize the site for feeding or sheltering activities).

120. RICHARD B. PRIMACK, ESSENTIALS OF CONSERVATION BIOLOGY 131-32 (1993) (citation omitted).

121. *See id.* at 133.

122. *See* MEFFE & CARROLL, *supra* note 115, at 131.

123. *See* PRIMACK, *supra* note 120, at 135-36.

124. *See id.* at 135.

125. *See* SMITH, *supra* note 114, at 315.

of open space for fear of predation from larger mammals or bird species.[126] Such fear of movement could prevent certain species from seeking out forage they require, finding that special someone for breeding, or even from nesting. Threats of habitat fragmentation can be an especially effective tool to protect endangered plant species that may be unable to disperse their seeds across fragments of habitat, especially plants that have thorny or sticky seeds that depend upon certain animals to carry their seeds long distances, or those which depend on pollinators such as bees, butterflies, or hummingbirds.[127]

Another important implication of habitat fragmentation is that it could reduce the foraging ability of animals.[128] A conservation biology textbook gives the following explanation:

> Many animal species, either as individuals or as social groups, need to be able to move freely across the landscape to feed on widely scattered resources. A given resource may be needed for only a few weeks in a year, or even only once in a few years, but when a habitat is fragmented, species confined to a single habitat fragment may be unable to migrate over their normal home range in search of that scarce resource .... Fences may prevent the natural migration of large grazing animals such as wildebeest or bison, forcing them to overgraze an unsuitable habitat and eventually leading to starvation of the animals .... Barriers to dispersal can also restrict the ability of widely scattered animal species to find mates, leading to a loss of reproductive potential.[129]

Finally, habitat fragmentation can perpetuate population decline by dividing a larger population into smaller subpopulations, each restricted from one another.[130] "These smaller populations are then more vulnerable to inbreeding depression, genetic drift, and other problems associated with small population size."[131] It is possible that none of the remaining habitat fragments can support a single subpopulation large enough to persist over time.[132]

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126. *See* PRIMACK, *supra* note 120, at 135.
127. *See id.* at 135-36.
128. *See id.* at 135.
129. *Id.* at 135-36.
130. *See id.* at 136.
131. *Id.* Inbreeding depression is defined as the detrimental effects of inbreeding. *See* SMITH, *supra* note 114, at G-7. Genetic drift occurs in small populations where "each mating will include only a sample of the already small sample of the population's genes. If the population remains small, this sampling error will continue from one generation to another ... [resulting in] genes ... becom[ing] fixed or homozygous for one allele, other alleles ... becom[ing] lost, and some will continue to segregate." *Id.* at 29-30.
132. *See* PRIMACK, *supra* note 120, at 136.

Even though any habitat fragmentation would appear to adversely affect an endangered species to some degree, the analysis must take into account the many fact-specific circumstances that must be assessed within the context of the particular case.[133] An example of habitat fragmentation may be necessary at this point:

> [I]magine [a] park being divided into four equal quarters by a north-south road 10 [meters] wide and by an east-west railroad track that is also 10 [meters] wide. The rights-of-way remove a total of . . . 2 hectares from the park. Since only 2% of the park is being removed by the road and railroad, city planners argue that the effects on the park are negligible. However, the reserve has now been divided into four fragments, each of which is 495 [meters] x 495 [meters] in area. The distance from the center of each fragment to the nearest point on the perimeter has been reduced to 247 [meters], which is less than half of the former distance. Since cats can now forage into the forest from the road and railroad as well as the perimeter, birds can successfully raise young only in the most interior areas of each of the four fragments. Each of these interior areas is 8.7 [hectares], for a total of 34.8 [hectares]. Even though the road and railroad removed only 2% of the reserve area, it reduced the habitat available to the birds by about half.[134]

Even though an analysis of habitat fragmentation must be limited to the specific case and species involved, some courts have admitted more general evidence concerning habitat fragmentation and its adverse effects on species.[135] In *Portland Audubon Society v. Lujan*, the plaintiffs were concerned with the Bureau of Land Management's sale of old-growth fir timber, which served as habitat for the northern spotted owl.[136] Evidence from several experts indicated that habitat fragmentation was the only human-related factor contributing to the decline in spotted owl population numbers.[137] The fragmentation of the habitat made it difficult for the owls to move from one patch of old-growth forest to another, and contributed to the variability of birth and death rates over time, the loss of genetic variation through

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133. *See* Loggerhead Turtle v. County Council of Volusia County, Fla., 896 F. Supp. 1170, 1179 (M.D. Fla. 1995).

134. Primack, *supra* note 119, at 134.

135. *See* Sierra Club v. Lyng, 694 F. Supp. 1260 (E.D. Tex. 1988); Portland Audubon Soc'y v. Lujan, 712 F. Supp. 1456 (D. Or. 1989), *aff'd in part, and rev'd in part*, 884 F.2d 1233 (9th Cir. 1989), *cert. denied*, 494 U.S. 1456 (1990).

136. *See Portland Audubon Soc'y*, 884 F.2d at 1234-35.

137. *See Portland Audubon Soc'y*, 712 F. Supp. at 1464.

inbreeding, and susceptibility to random catastrophes.[138] The court recognized that fragmentation was of particular importance because the northern spotted owl requires old-growth forest for every aspect of its life, and such "[s]pecies with specialized habitat requirements often are incapable of altering this behavior."[139] The court also recognized that fragmentation resulted in an increase of open habitat which made the spotted owls more susceptible to predation from great horned owls, barred owls, and northern goshawks.[140] Finally, fragmentation of the old-growth forest resulted in a juvenile mortality rate close to one hundred percent and a decrease in nesting success.[141] It can be inferred from the data that the owls' breeding, feeding, and sheltering behavior were all adversely affected from the logging of the old-growth timber stands, resulting in fragmentation of the northern spotted owls' habitat.

Similarly, in *Lyng*, the court allowed the admission of evidence regarding certain timber management activities by the Forest Service which adversely affected populations of the red-cockaded woodpecker.[142] In this case, despite the fact that no dead woodpeckers were found, the court still found a "take" because a severe decline in the population could be directly attributed to the Forest Service's even-aged management practices.[143] The evidence showed that fragmentation resulted in the separation of nesting and foraging areas.[144] The court also found that the Forest Service's failure to control hardwood mid-story encroachment around cavity trees, its failure to employ regularly prescribed fires to control hardwood and young pine encroachment, and its failure to provide an appropriate basal area in colony stand sites contributed to the adverse effects of the forest fragmentation.[145]

Specifically, the court in *Sierra Club v. Lyng* found that, first, "isolation of particular colonies [from fragmentation] interferes with breeding practices, since males cannot find females to breed with, thereby contributing to the population decline. Isolation also causes the gene pool to be reduced with fewer birds in a given area."[146] Second, since the woodpeckers do not feed on the ground, removing trees near colonies reduces the foraging areas available to the birds and further forces the birds to expend more energy to search for new trees with food than they can receive back from the nourishment they

138. *See id.*
139. *Id.* at 1467.
140. *See id.* at 1473.
141. *See id.* at 1474.
142. *See Lyng*, 694 F. Supp. at 1268-69.
143. *See id.* at 1271.
144. *See id.* at 1272.
145. *See id.* at 1266-67.
146. *Id.* at 1271-72.

eventually locate.[147] Third, the timber practices have eliminated the potential stands of trees required by the woodpeckers for excavation of cavities for nests.[148] Finally, removing trees subjects the remaining potential nesting trees to wind-blown effects since windbreaks have been removed.[149] Due to all the available evidence before it, the court concluded that the habitat altering activities of the Forest Service resulted in a "taking" of the red-cockaded woodpeckers.[150]

There can be little doubt that evidence of habitat fragmentation can be found to surpass the expectations of *Sweet Home*, as evidenced by the court in *Sierra Club v. Lyng*. Even though the case is pre-*Sweet Home*, the harm regulation is still applicable, and the court was careful to insure that the mandates of the regulation were met.[151] In the abstract, there should be little problem for evidence of habitat fragmentation to meet the *Daubert* standard as well. First, all of the contentions concerning fragmentation can be tested.[152] Second, the amount of peer review and publication is without limit—there are many articles and books written on the effects of habitat fragmentation.[153] Finally, the fact that habitat fragmentation was mentioned in significant part in several texts and referenced in several more sources indicates a general acceptance among the scientific community.[154]

In the abstract, depending upon the facts of the case, evidence of habitat fragmentation should show causation in order to meet the *Daubert* standard of admission. The difficulty with this issue is the variability between the species. It is important to know the life history characteristics of the species at issue and to insure that these characteristics are well studied before bringing a case to court. If brought in good faith, it is difficult to imagine a case where habitat fragmentation could be dispelled, so long as the plaintiffs can relate the principles outlined above to a well-proven set of life history characteristics.[155]

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147. *See id.* at 1272.

148. *See id.*

149. *See id.*

150. *See id.* at 1271.

151. *See id.* at 1270-71.

152. For example, as fragmentation of habitat increases, nesting success decreases, or predation increases, or foraging success decreases, etc. *See* King, *supra* note 110, at 164-65.

153. Each of the texts consulted for this article had a portion of a chapter devoted to habitat fragmentation, and as a total cited to no fewer than 10 outside sources (articles and books) to consult for further review. *See* MEFFE & CARROLL, *supra* note 115, at 131-32; PRIMACK, *supra* note 120, at 130-36; SMITH, *supra* note 114, at 315-17. *See also* King, *supra* note 110, at 165 (noting 22 articles published in peer reviewed journals and 17 books about the subject).

154. *See* sources cited *supra* note 153.

155. Life history characteristics are everything needed to become familiar with a species, such as a species' food and water requirements, nutritional requirements, cover, movements, reproduction, nesting, behavior, and physiology, just to name a few. *See* JAMES A. BAILEY, PRINCIPLES OF WILDLIFE

B. Edge Effects

The concept of edge effects is directly related to habitat fragmentation in that fragmentation increases the amount of edge of a certain type of habitat relative to the amount of interior habitat.[156]

> The microenvironment at the fragment edge is different from that of the interior. Some of the more important edge effects include microclimatic changes in light, temperature, wind, and the incidence of fire .... Each of these edge effects can have a significant impact on the vitality and composition of the species in the fragment.[157]

Edge effects usually result in a higher composition of species in an area because fragment edge is usually thought of as a matrix of two or more habitats, and as a result, has the ability to support more species that are adaptable to such areas.[158] However, such effects usually do not mean positive effects for species that are at risk of extinction.[159] As species composition increases from an increase in edge, an endangered species could be adversely affected by an increase in predator species or by a decline in prey species as well. An increase in species composition could also remove available nesting or breeding habitat from the endangered species; as a result edge has the ability to disrupt feeding, sheltering, and breeding behavior.[160] Most importantly, "[i]f patches of vegetation are too small to support their characteristic species the area becomes a homogeneous community dominated by edge species."[161]

If the endangered species at issue happens to be a plant species, edge becomes even more important in determining the effects of the habitat modifications. An ecology text gives the following example:

> The edge effect comes about because environmental conditions differ from those adjacent vegetational communities, especially adjoining forests. Increased solar radiation in the newly created edge, high temperature, and exposure to wind result in a high rate

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MANAGEMENT 341 (1984).

156. *See* PRIMACK, *supra* note120, at 137.

157. *Id.* (citation omitted).

158. *See* MEFFE & CARROLL, *supra* note 115, at 255.

159. *See id.* at 255-56. "For example, birds characteristic of forest interior habitats may be unable to maintain their populations in landscapes where edge is abundant; instead, the landscape may gradually become dominated by edge-adapted species not in great need of conservation." *Id.* at 256.

160. *See id.* at 256-58.

161. SMITH, *supra* note 114, at 311.

> of evaporation. Plants place increased demands on soil moisture. Sudden exposure to sunlight subjects trees to stress from the increased heat and light. Some mesic [moderately moist habitat], shade-tolerant trees succumb. Others are injured by sun scald. Light-tolerant species respond by increasing crown growth and epicormic branching (new branching sprouting on the trunk) . . . . Therefore an edge favors xeric, light-demanding species capable of competing successfully for available soil moisture.[162]

Several courts have admitted evidence of edge effects as proof that a certain habitat modification was affecting an endangered species. In *National Audubon Society v. Hoffman*, several conservation organizations challenged decisions of the Forest Service to extend roads and conduct extensive logging operations in the Green Mountain National Forest.[163] Even though no endangered species were at issue, the area had been designated critical black bear habitat by the State of Vermont and was known nesting habitat for several species of neotropical birds.[164] The court admitted the evidence concerning edge effects and concluded that such "openings in the forest cover created by logging efforts would endanger the neotropical bird population by making it vulnerable to predators inhabiting the boundaries of forest clearings...."[165]

In *Krichbaum v. Kelley*, the court found evidence of edge effects admissible for purposes of proving that the Forest Service's management actions in a national forest were arbitrary and capricious.[166] The court defined edge effects as a "discontinuity of forest cover caused by logging and logging access roads. The effects may include increased light, wind, and predator penetration into the forest interior, with accompanying effects on biodiversity."[167]

In *Florida Power Corp. v. Florida Department of Environmental Regulation*, the court utilized an expert's testimony concerning edge effects, along with the testimony of several other environmental experts, to affirm the denial of an application for a wetland resource permit to install a power line.[168] The opinion by the court is unique in that the evidence of edge effect

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162. *Id.* at 311-12.

163. *See* National Audubon Soc'y v. Hoffman, 132 F.3d 7, 11 (2d Cir. 1997).

164. *See id.*

165. *Id.*

166. *See* Krichbaum v. Kelley, 844 F. Supp. 1107, 1116 (W.D. Va. 1994). Despite finding the evidence to be admissible, the court "can find nothing arbitrary and capricious about the agency's treatment of this diversity-related issue." *Id.*

167. *Id.*

168. *See* Florida Power Corp. v. Florida Dep't of Envtl. Regulation, 638 So. 2d 545, 561-62 (Fla. Dist. Ct. App. 1994).

was admitted by the court not to show any harm to a species of wildlife but rather to show that a majority of the wildlife was likely to be affected positively from the edge effects, and any negative effects would be minimal.[169] Even though the proffered purpose of the evidence was not used in its usual manner of showing a negative impact on a wildlife species, it was still accepted by the court as a sound scientific theory on which to base its decision.

Since case law has frequently utilized "edge effects," it is not surprising that the principle possesses all of the requirements to pass the *Daubert* test. First, the premises relied upon from the edge effects principle can be tested to determine if they are valid or not.[170] Second, using the same texts as above, no fewer than thirty peer review articles or books were cited to in support of the edge effects principle.[171] Finally, as with habitat fragmentation, such widespread publication in many peer review journals and text books indicates that the principle of edge effects is generally accepted among the scientific community.[172]

A plaintiff seeking to introduce evidence of edge effects need look no further than *Sierra Club v. Marita* for proof that the principle of edge effects meets the *Daubert* standard.[173] In a challenge to the Forest Service's management plans for the Nicolet and Chequamegon National Forests, the court accepted evidence of edge effects.[174] The court defined edge effects as "the extent to which a habitat is penetrated by adverse external forces ...," and gave the following example: "the invasion of an old-growth forest by plants and animals (deer are of particular concern) from a surrounding younger forest."[175] Despite agreeing with the Forest Service's decision not to use the

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> Steve Godley . . . testified as an expert in endangered and threatened species, wildlife ecology, and wetland resource permitting. He presented the results of an analysis of the impacted area, including evaluation of "edge effect" using on-site sampling and data collection to compare the biota in the corridor, on the edge, and in the forest. He also presented the results of a literature search of scientific studies on electrical transmission line construction impacts, particularly in forested wetland areas, and a comparative assessment of eight other transmission lines.

Id. at 551.

169. *See id.* at 552.

170. For example, as the amount of edge increases, the population numbers, breeding success, nesting success, decrease, or maybe the amount of predation increases. *See* MEFFE & CARROLL, *supra* note 115, at 254-58.

171. *See* SMITH, *supra* note 114, at 310-12; PRIMACK, *supra* note 120, at 137-42; MEFFE & CARROLL, *supra* note 115, at 254-58.

172. *See* sources cited *supra* note 171. *See also* King, *supra* note 110, at 165.

173. *See* Sierra Club v. Marita, 843 F. Supp. 1526 (E.D. Wis. 1994), 845 F. Supp. 1317 (E.D. Wis. 1994), *aff'd*, 46 F.3d 606 (7th Cir. 1995).

174. *See Marita*, 843 F. Supp. at 1537. *See also Marita*, 845 F. Supp. at 1324.

175. *Marita*, 843 F. Supp. at 1537; *Marita*, 845 F. Supp. at 1324.

challengers' choice of science in developing the management plans, the court found the evidence of edge effects to be a well accepted scientific theory, and even noted the volumes of scientific literature (dating from the 1960s and 1970s) that the Fish and Wildlife Service had accumulated prior to the trial.[176]

The scientific principle of edge effects is routinely admitted as evidence into courts of law for cases dealing with the adverse effects of habitat fragmentation. However, plaintiffs should be wary not to rely solely upon this principle for proving harm to a protected species via habitat modification. As the aforementioned cases demonstrate, especially *Sierra Club v. Marita*, *Krichbaum v. Kelley*, and *Florida Power Corp. v. Florida Department of Environmental Regulation*, courts usually accept such science into evidence but are not always persuaded by its value and often do not rely upon edge effects evidence alone in formulating decisions.

C. Pollution

Probably the most subtle form of habitat modification is the pollution of our air, water, and soil from pesticides, industrial pollution, automobile emissions, and sediment deposits.[177] As with the previous forms of habitat modifications, pollution is case specific and requires a factual inquiry in order to determine if the proper causation principles have been met. Even though tying causation to the effects of pollution can be tenuous depending upon the chain of custody of the pollution and any relationship to other kinds of pollution, pollution can kill species living in land and aquatic environments.[178]

Pollution as a form of habitat modification is important for endangered species litigators to be aware of because of the vast array of possibilities that exist. A very short list would include aquatic pollutants (crude oil, hydrocarbon, and carcinogens), heavy metals (methyl mercury poisoning and lead poisoning), air pollution (sulphur dioxide and acid rain), fluoridation, and pesticides (organochlorines, DDT, and PCBs).[179] For instance,

> [c]ontamination of water . . . comes from many sources: discharge of untreated industrial wastes into watercourses, leaching of liquids from industrial or municipal waste dumps into surface or ground water [sic], inadequate treatment of municipal sewage, and

176. *See Marita*, 843 F. Supp. at 1537-38. *See also Marita*, 845 F. Supp. at 1324.

177. *See* PRIMACK, *supra* note 120, at 146.

178. *See id.* at 149.

179. *See* NATIONAL ACADEMY OF SCIENCES, ANIMALS AS MONITORS OF ENVIRONMENTAL POLLUTANTS vii-xii (1979).

> hazardous and toxic materials flushed into watercourses during storms because of poor solid waste management.[180]

Air pollution emanates from "emissions from vehicles, industrial boilers, and domestic heating sources [which] exceed the capacity of cities' natural ventilation systems to disperse and dilute these emissions to nonharmful exposure levels."[181] Types of air pollution that can harm species of fish and wildlife include, but are not limited to, sulphur dioxide (from oil burned in power generation), suspended particulate matter (from domestic fires and power and industrial plants), and carbon monoxide and nitrogen dioxide (from gasoline fumes of cars).[182]

The possibilities are endless due to the varying types of pollution and the many different methods in which pollution can harm wildlife. Pollution can reach wildlife through basic inhalation, ingestion of contaminated vegetation, ingestion of contaminated carcasses, absorption through their skin, across their gills, and in the water.[183] One pollutant may affect one habitat or species but may not so easily affect another. Different types of habitats and species present different risks and show different vulnerabilities to different types of pollution.[184] Not all pollution is the same, nor does it affect fish or wildlife in the same manner.

The scope of this topic is too diverse to be covered in this Note, but some courts have been willing to invoke liability for pollution in the habitats of endangered species.[185] For example, the courts in *American Bald Eagle v. Bhatti* and *National Wildlife Federation v. Hodel* both addressed the issue of endangered bald eagle habitat modifications by lead contamination.[186] In *American Bald Eagle*, the alleged lead poisoning was a result of deer hunting on a Massachusetts state reservation where bald eagles were known to inhabit.[187] Allegedly, some deer were wounded but managed to escape their hunters into the woods and eventually died; bald eagles would later feed on

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180. Ellen M. Brennan, *Air/Water Pollution Issues in the Mega-Cities*, *in* POPULATION GROWTH AND ENVIRONMENTAL ISSUES 152 (Shridath Ramphal & Steven W. Sinding eds., 1996).

181. *Id.* at 156-57 (citation omitted).

182. *See id.* at 157.

183. *See* EPA, AIR POLLUTION AND ACID RAIN REPORT NO. 3, THE EFFECTS OF AIR POLLUTION AND ACID RAIN ON FISH, WILDLIFE, AND THEIR HABITATS 37-39 (1982).

184. *See* B. Ganning et al., *Recovery and Restoration of Rocky Shores, Sandy Beaches, Tidal Flats, and Shallow Subtidal Bottoms Impacted by Oil Spills*, *in* RESTORATION OF HABITATS IMPACTED BY OIL SPILLS 17 (John Cairns, Jr. & Arthur L. Buikema, Jr. eds., 1984).

185. *See, e.g.*, Defenders of Wildlife v. EPA, 688 F. Supp. 1334 (D. Minn. 1988), *aff'd in part and rev'd in part*, 882 F.2d 1294 (8th Cir. 1989) (holding that EPA's continued registration of strychnine rodenticide constituted an impermissible taking of 18 protected species).

186. *See* American Bald Eagle v. Bhatti, 9 F.3d 163 (1st Cir. 1993); National Wildlife Fed'n v. Hodel, 23 E.R.C. 1089 (E.D. Cal. 1985).

187. *See American Bald Eagle*, 9 F.3d at 164.

the carcasses, ingest lead shot, and become contaminated with lead.[188] The court stated that "bald eagles can be harmed by the ingestion of lead," even though in this case there was no evidence that the hunt actually caused harm to any specific bald eagles.[189]

In *Hodel*, the court enjoined a U.S. Fish and Wildlife Service sponsored hunt on migratory birds in five states.[190] The court found that ingestion of lead shot by bald eagles contributed to "blindness, lack of coordination, neurological dysfunctions, behavioral aberrations, and increased susceptibility to diseases."[191] In effect, the lead poisoning led to premature death or an overall decline in the health of the bald eagles.[192]

Pollution-related harm differs among species, and most courts are willing to recognize the uniqueness that some forms of pollution may have on differing species. For example, in *Loggerhead Turtle v. County Council of Volusia County, Florida*, light pollution was the source of controversy.[193] Loggerhead turtles were protected by the ESA, and the court specifically found that harm from light pollution occurred from:

> [a]rtificial beachfront lighting from buildings, streetlights, dune crossovers, vehicles and other types of beachfront lighting [that] have been documented in the disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchling turtles and that nesting females avoided areas where beachfront lights were the most intense or aborted nesting attempts at a greater frequency in lighted areas.[194]

In *Defenders of Wildlife v. EPA*, the court found a "taking" of eighteen species of endangered or threatened wildlife by the EPA's registration of strychnine that was registered for use as a rodenticide.[195] Substantial evidence existed showing that protected species had died from strychnine poisoning, but there was no evidence in the opinion as to the chain of possession of strychnine or any other links between the EPA's registration and the death of

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188. *See id.*

189. *Id.* at 166.

190. *See Hodel*, 23 E.R.C. at 1089-94.

191. *Id.* at 1090.

192. *See id.* The court found that since 1976, there had been 96 bald eagle deaths due to lead poisoning and 23 deaths in 1984 alone. *See id.*

193. *See* Loggerhead Turtle v. County Council of Volusia County, Fla., 148 F.3d 1231 (11th Cir. 1998).

194. *Id.* at 1235 (citations omitted). The court remanded the case back to the district court for further review after standing was affirmed for the plaintiffs. *See id.* at 1232.

195. *See Defenders of Wildlife*, 688 F. Supp. at 1351.

the protected species.[196] It is difficult to determine if the court's "but-for" causation analysis would be sustained after *Sweet Home*, but it is not impossible to imagine situations involving pollution where protected species could be adversely affected directly from pollution itself.

For example, "toxic wastes in aquatic environments can diffuse over a wide area and be actively carried by currents . . . . Furthermore, species that feed on aquatic species are exposed to the concentrated levels of toxic chemicals."[197] In order to meet the *Daubert* standard for admissibility, one could rely upon volumes and volumes of peer review journals and books that discuss the effects of pesticides, herbicides, water pollution, acid rain, and air pollution on species' habitats.[198] It is important to note that courts should not be persuaded by the social benefits to humans from the activities causing the pollution because it is well established in case law that there is no level of threat to endangered species that can be deemed "insignificant;" furthermore, the ESA is not a statute that allows for the balancing of the harms.[199] There is no doubt that the effects of pollution are generally accepted among the scientific community, and these effects are certainly subject to tests and inferences that can be, and usually have been, proven. However, litigators should at all times remain cognizant of the fact that causation still must be proven in all cases. It is not enough to simply assert a harm, but the harm must actually be proven, in a trial, as originating from a defendant's conduct or actions.

CONCLUSION

With the sweeping power that Congress and the Supreme Court in *Sweet Home* have afforded section 9 of the ESA, one cannot help but contemplate the effect such a provision has on all private property in the country. The ability of any plaintiff to claim that some land use activity is harming a

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196. *See id.*

197. PRIMACK, *supra* note 120, at 149.

198. *See id.* at 145-64. The chapter of this text alone cites to no less than 30 peer reviewed articles and books discussing the various effects from the various possibilities of pollution. *See id. See also* EPA, AIR POLLUTION AND ACID RAIN REPORT NO. 3, *supra* note 182 (reference list is 44 pages in length of various articles and journals detailing the effects of pollution on certain types of wildlife).

199. *See Defenders of Wildlife*, 688 F. Supp. at 1354. *See also* Tennessee Valley Auth. v. Hill, 437 U.S. 153, 184 (1978) (even though the $100 million Tellico Dam was virtually complete and Congress continued to appropriate large sums of money towards its completion, the Court enjoined any impoundment of the Little Tennessee River, which would eradicate a known population of the snail darter).

protected species is not to be underestimated. So long as that plaintiff is able to find one dead bird, fish, or animal, or prove a sufficient likelihood of harm to any protected wildlife on that particular piece of land, the court's power to enjoin the land use activity cannot be doubted. The Supreme Court has upheld the broad powers of the ESA in *Tennessee Valley Authority v. Hill* and has upheld broad regulations concerning the wide reach of the ESA in *Sweet Home*.

There can be little doubt that Congress envisioned the ESA as the ultimate tool to be used in the battle to preserve endangered wildlife and plant species. No case has appeared before any court alleging that the harm regulation is a Fifth Amendment "taking" that requires just compensation, but it is only a matter of time before such a claim is made. If such protections of endangered species are not utilized, or are found to be "takings" requiring just compensation, is the ESA still as powerful as Congress envisioned?

At present, until such questions are answered by either Congress or the Supreme Court, the ESA has the potential to become a federal land use act. Whether used by the government or by citizens, the ESA can prevent the uses of land as private landowners see fit, at least the uses that detrimentally affect our endangered wildlife. As our knowledge of such issues as habitat fragmentation, edge effects, and the effects of pollution increase, along with our basic understandings of science, the ability to prove a significant harm to any endangered species becomes all too apparent. Aldo Leopold once quipped, "[e]ducation, I fear, is learning to see one thing by going blind to another."[200] Is that the result of the ESA? As we learn more and more about the world around us and the importance of the environment and our ability to augment it so easily, are we going blind to our needs and to our self-importance as well? In order to see how beautiful and important the world really is, must we give up a part of ourselves to preserve it? In which direction will Congress or the courts proceed: protection of the environment, or protection of our basic property rights granted to us by the Constitution of the United States, or is there a middle ground which Congress has yet to create?

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200. LEOPOLD, *supra* note 8, at 168.