Insect Conservation under the Endangered Species Act

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ABSTRACT

While the rate of extinction is the same for insects and other animals, insects are underrepresented in the Fish and Wildlife Service's list of threatened or endangered species. Insect conservationists have argued that the Endangered Species Act and the Fish and Wildlife Service are biased against insects, despite the importance of insects in our lives. The reality, however, is that there is only minimal bias inherent in the provisions of the Endangered Species Act or in regulations promulgated by the Fish and Wildlife Service. The main cause of the low number of insect species listed under the Endangered Species Act is a lack of qualified biologists to file and review listing petitions. Until sufficient information about insect conservation is available, petitioners could use surrogate species to protect threatened or endangered insect species.

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I.
INTRODUCTION

Most people are oblivious to the indispensable role insects play in our lives. The disappearance of insects would mean the loss of a vital food source without which most reptiles, mammals, amphibians, and birds would die.[1] Flowering plants, which cover most of the land surface, would be unable to survive without insects facilitating their reproduction and providing favorable soil conditions.[2] The surface of the earth would be covered with dead vegetation and animals, and would sustain only wind-pollinated plants and very little animal life.[3] Humans would not last more than a couple of months in an insect-less environment.[4]

Insects also provide valuable services for free. A recent study has valued the ecological services insects provide within the United States at $57 billion.[5] The study focused on services provided by wild native insects in the areas of dung burial, pest control, pollination, and wildlife nutrition.[6] Dung burial services

1. EDWARD O. WILSON, THE DIVERSITY OF LIFE 133 (Harvard Univ. Pres 1992) [hereinafter WILSON, DIVERSITY]; Scott H. Black et. al., *Endangered Invertebrates: The Case for Greater Attention to Invertebrate Conservation*, 18 ENDANGERED SPECIES UPDATE 42, 43 (2001); John E. Losey & Mace Vaughan, *The Economic Value of Ecological Services Provided by Insects*, 56 BIOSCIENCE 311, 319 (2006).

2. WILSON, DIVERSITY, *supra* note 1, at 133; Losey & Vaughan, *supra* note 1, at 313, 315.

3. WILSON, DIVERSITY, *supra* note 1, at 133.

4. *Id.*

5. Losey & Vaughan, *supra* note 1, at 312.

6. *Id.* at 311-12.

provided by a single species, dung beetles, are valued at $380 million.[7] Insect parasites and predators provide $4.5 billion worth of pest control services for our crops.[8] Insect pollinators, mostly bees, are responsible for approximately $3.07 billion of American crops.[9] Wildlife nutrition provided by insects resulted in $49.93 billion worth of hunting, fishing, and bird watching.[10] While these figures are significant, they vastly underestimate the economic value of insects for human society.[11]

Insects are also the undisputed winners of the game of survival in the history of this planet. The first insects appeared approximately 400 million years ago and since then have managed to inhabit almost all land and aquatic habitats, and have acquired flight.[12] Today, insect species greatly outnumber all other animal species and make up over half of all organisms identified by man.[13] Another five to eight million more insect species are thought to exist, but have not been discovered or identified.[14] Careful bioprospecting[15] of this incredible insect biodiversity could yield valuable genetic and chemical raw materials that could be used to create new transgenic strains of plants and animals or the next round of cutting-edge pharmaceuticals.[16]

Yet insect biodiversity faces the same ecological threats as all other biodiversity.[17] Scientists agree that human activities have

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7. *Id.* at 314-15.

8. *Id.* at 319.

9. *Id.* at 316.

10. *Id.* at 319-20.

11. The authors of the study noted that other potentially important services, like decomposition of dead organisms and soil improvement, could not be easily quantified and were excluded. *Id.* at 312. The study also ignored services provided by insects outside of the United States, including the use of insects as part of the human diet. *See generally* Gene R. DeFoliart, *Insects as Food: Why the Western Attitude Is Important*, 44 ANN. REV. ENTOMOLOGY 21 (1999) (detailing the different types of insects used as food sources around the world).

12. NEIL A. CAMPBELL, BIOLOGY 614 (4th ed. 1996).

13. WILSON, DIVERSITY, *supra* note 1, at 134, 136.

14. Black, *supra* note 1, at 42.

15. Bioprospecting is "[t]he exploration of wild biodiversity in search of useful resources." EDWARD O. WILSON, THE FUTURE OF LIFE 124 (2002) [hereinafter WILSON, FUTURE].

16. *See* Nat'l Ass'n of Home Builders v. Babbitt, 130 F.3d 1041, 1052-54 (D.C. Cir. 1997) (describing the economic importance of biodiversity to the medical field and interstate commerce); WILSON, FUTURE, *supra* note 15, at 114-28 (describing bioprospecting of biodiversity for use in genetic engineering and medicine).

17. *See* Tonya Van Hook, *Insect Coloration and Implications for Conservation*, 80 FLA. ENTOMOLOGIST 193, 194 (1997) (explaining that insects are as vulnerable as vertebrates in the face of human activity).

led to an increased rate of extinction worldwide.[18] While no one knows exactly how many species exist and a definite rate of extinction is impossible to calculate,[19] the consensus is that current rates of extinction are between 1,000 to 10,000 times greater than the rate before human activities significantly affected the environment.[20] This increase in the rate of extinction is so dramatic that some biologists believe we are currently experiencing a mass extinction that will lead to the disappearance of most organisms worldwide.[21]

A recent empirical study suggests that the rate of extinction of insects is comparable to the rate of extinction of plants and vertebrates.[22] Insect species might even be more prone to extinction than vertebrates because their short lifespan and small size make them more vulnerable to environmental changes.[23] Their inconspicuous habitats, abundance in tropical areas, and behavioral characteristics also increase their vulnerability.[24] For example, some insect species swarm while feeding or mating, concentrating most of their members in a particular habitat.[25] If this habitat is converted to a recreational area, the lack of access to food or mates might lead to the disappearance of the entire species.[26]

The Endangered Species Act (ESA)[27] has the potential to mitigate or eliminate the impact of habitat change on insect species.[28] The Supreme Court recognized that "[t]he plain intent of

18. CAMPBELL, *supra* note 12, at 1168; Ed Stoddard, *Ultimate Number Crunch*, Mercury (Hobart, Austl.), Mar. 20, 2006, at 19.

19. Stoddard, *supra* note 18.

20. WILSON, FUTURE, *supra* note 15, at 99.

21. WILSON, DIVERSITY, *supra* note 1, at 280; J.A. Thomas et al., *Comparative Losses of British Butterflies, Birds, and Plants and the Global Extinction Crisis*, 303 SCIENCE 1879, 1881 (2004)

22. Thomas, *supra* note 21, at 1881.

23. Black, *supra* note 1, at 45.

24. Van Hook, *supra* note 17, at 194-97.

25. *Id.* at 196.

26. *See* Mike Lee, *Suit Seeks Protection of Dune Species*, SAN DIEGO UNION-TRIB., Oct. 21, 2005, at B10, available at 2005 WLNR 17151568 (describing the threat posed by off-road vehicles to insect species endemic to the Algodones Dunes); Scott Sonner, *Conservationists' Suit Seeks Protection for Rare Butterfly*, MONTEREY COUNTY HERALD (Cal.), Jan. 6, 2006 (describing the threat posed by off-road vehicles to the Sand Mountain Blue Butterfly).

27. Endangered Species Act of 1973, 16 U.S.C. §§ 1531-1544 (2000).

28. *See* J.B. Ruhl, *Section 4 of the ESA: The Keystone of Species Protection Law*, in THE ENDANGERED SPECIES ACT DESKBOOK 19 (Donald C. Baur & William R. Irvin eds., 2002) (describing the types of protections triggered by listing under the ESA).

Congress in enacting [the ESA] was to halt and reverse the trend toward species extinction, whatever the cost."[29] The conservation of species on the brink of extinction is listed as one of the stated purposes in the ESA.[30] Congress was concerned about the extinction of any species[31] and, unlike earlier conservation legislation,[32] the ESA extends its protection to insects and other invertebrates.[33] The agency charged with implementing the ESA, the Fish & Wildlife Service (FWS), has honored this congressional intent and currently recognizes forty-nine insects as endangered or threatened.[34]

However, insect conservationists have argued that the ESA and the FWS are biased against insects in the development of recovery plans and the amount of money spent for insect conservation as opposed to vertebrate conservation.[35] But the most striking type of bias against insects described by critics of the ESA and the FWS involves the listing decisions required for legal protection.[36] While the rate of extinction is the same for insects and other animals and insects make up over 50% of all known species,[37] less than 3% of all species listed by the FWS as threatened or endangered are insect species.[38] The ESA and the

29. Tenn. Valley Auth. v. Hill, 437 U.S. 153, 184 (1978).

30. 16 U.S.C. § 1531(b) (2000).

31. *Tenn. Valley Auth.*, 437 U.S. at 177. During the hearings before the enactment of the ESA, the Senate Environmental and Public Works Committee recognized that "[b]iologically it makes sense to treat all taxonomic groups equally or even to place some special emphasis on protecting plants and invertebrates since they form the bases of ecosystems and food chains upon which all other life depends." John Copeland Nagle, *Playing Noah*, 82 MINN. L. REV. 1171, 1253 (1998) (citing S. Rep. No. 97-418, at 14 (1982)).

32. Shannon Petersen, *Bison to Blue Whales: Protecting Endangered Species Before the Endangered Species Act of 1973*, 22 ENVIRONS ENVTL. L. & POL'Y J. 71, 104 (1999).

33. 16 U.S.C. §§ 1532(8), 1532(16), 1533.

34. U.S. Fish & Wildlife Service, Endangered Species Information: Insects, http://www.fws.gov/endangered/wildlife.html (last visited May 8, 2006) (follow "Insects" hyperlink).

35. Black, *supra* note 1, at 44-45; Janice L. Bossart & Christopher E. Carlton, *Insect Conservation in America: Status and Perspectives*, 48 AM. ENTOMOLOGIST 82, 90-91 (2002); Timothy D. Male & Michael J. Bean, *Measuring Progress in US Endangered Species Conservation*, 8 ECOLOGY LETTERS 986, 990 (2005); Van Hook, *supra* note 17, at 200-203. Contra C.V. Wilcox & B.D. Elderd, *The Endangered Species Act Petitioning Process: Successes and Failures*, 16 SOC'Y & NAT. RESOURCES 551, 557 (2003).

36. Black, *supra* note 1, at 44; Nagle, *supra* note 31, at 1194, 1197.

37. WILSON, DIVERSITY, *supra* note 1, at 134; Thomas, *supra* note 21, at 1881.

38. U.S. Fish & Wildlife Service, Endangered Species Information: Our Boxscore, http://www.fws.gov/endangered/wildlife.html (last visited May 8, 2006) (follow "Our summary of the number of listed species, updated daily" hyperlink).

FWS appear to favor more popular species over insects,[39] despite insects' ecological, economical, and evolutionary significance.

However, as this Article shows, the dearth of insects listed under the ESA owes more to a lack of scientific data on insect species, other than butterflies and beetles, than to biases in the listing provisions of the ESA or the regulatory mechanisms developed by the FWS. Part II of this Article describes the general framework of the ESA, including relevant definitions and protections afforded to qualifying species. Part III focuses on the statutory and regulatory aspects of listing decisions and their effects on insect conservation. Part IV concludes that any problems in listing insects under the ESA can be corrected by improving scientific knowledge, considering a species' ecological significance when making listing decisions, and using surrogate species to protect areas inhabited by insects and threatened by habitat destruction.

II.
PROTECTION OF THREATENED AND ENDANGERED SPECIES

A. *The Problem of Extinction*

For most of Earth's history, extinction[40] has been a generally slow process, proceeding at a pace of one species per million each year.[41] Human activity has increased the rate of extinction exponentially.[42] As humanity's habitat spread from Africa and the Middle East, it faced few organisms able to resist its expansion, with the result that humanity drove many native species to

39. For example, mammals make up 19% of all listed species but account for less than 1% of all known species. WILSON, DIVERSITY, *supra* note 1, at 134, 136; U.S. Fish & Wildlife Service, *supra* note 38.

40. During the voyage of the Beagle, Darwin was puzzled by giant ground sloth fossils he found in Argentina. ADRIAN DESMOND & JAMES MOORE, DARWIN 128-29 (1991). Two months later he received a copy of volume two of Charles Lyell's Principles of Geology, which explained that species would die naturally whenever there was any change to their environment, but found it unsatisfactory and continued to search for a better explanation many years after returning to England. *Id.* at 131, 159-60, 224, 230-31. Darwin settled on a variation of Lyell's explanation: extinction was the result of the inability of a species to adapt to changing environmental conditions. *Id.* at 231. Time has shown that Darwin's explanation is correct, but it is an oversimplification of the mechanisms leading to extinction. *See generally* WILSON, DIVERSITY, *supra* note 1, at 215-42 (describing modern explanations of how extinction takes place).

41. WILSON, FUTURE, *supra* note 15, at 99.

42. *Id.* at 98-99.

extinction.[43] This trend continues today with habitat destruction, invasive species, pollution, population growth, and overharvesting as the main human forces driving extinction.[44]

To illustrate, the interplay of these forces led to a dramatic decrease in the American bison population from 25 million to just 86 in the late 1800s.[45] Expansion and settlement onto the Great Plains encroached on the bison's native habitat and brought domestic livestock that competed with the bison for pasture.[46] Bison were hunted for food, for sport, and to meet increased demand for leather machine belts made from bison hides.[47] Congress recognized extinction of the bison as a national problem because bison were migratory animals that roamed through several states, making state regulation difficult. However, Congress ultimately decided not to protect the bison, reasoning that extinction was the inevitable price of Manifest Destiny and that preserving bison would worsen the "Indian problem."[48]

The near-extinction of the bison was followed by threats to migratory birds, bears, and bald eagles.[49] The national response to these threats was a patchwork of ad hoc statutes protecting individual groups of animals rather than comprehensive legislation.[50] It wasn't until the national environmental movement of the 1960s that comprehensive conservation legislation was enacted.[51] However, these early attempts at comprehensive conservation legislation were flawed because they concentrated on vertebrates, especially species representative of the national heritage,[52] or provided insufficient protection for species on the verge of extinction.[53]

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43. *Id.* at 98.

44. *Id.* at 50; Jim Chen, *Across the Apocalypse on Horseback: Imperfect Legal Responses to Biodiversity Loss*, 17 J.L. & POL'Y 12, 14 (2005).

45. Petersen, *supra* note 32, at 75-79.

46. *Id.* at 76-77.

47. *Id.*

48. *Id.* The bison was eventually saved by the creation of wildlife preserves and national parks. *Id.* at 79.

49. *Id.* at 81-90.

50. *Id.*

51. *Id.* at 95.

52. *Id.* at 99-103.

53. LAWRENCE R. LIEBESMAN & RAFFE PETERSEN, ENDANGERED SPECIES DESKBOOK 7 (2003).

B. *The Endangered Species Act of 1973*

When the ESA was enacted in 1973, it was the most comprehensive legislation for the conservation of species in danger of becoming extinct ever enacted.[54] The ESA was based on congressional findings that various American species had become extinct due to human activity and other species of "esthetic, ecological, educational, historical, recreational, and scientific value" were in danger of extinction.[55] With this legislation, Congress created a comprehensive set of positive obligations and strict requirements allowing few exceptions.[56]

1. Purposes of the ESA

The ESA lists as its purposes the conservation of endangered and threatened species, the conservation of ecosystems on which endangered and threatened species depend, and the fulfillment of legal obligations arising under treaties listed within the statute.[57] The Supreme Court recognized that the purpose of the ESA was "to halt and reverse the trend toward species extinction, whatever the cost."[58] Thus, under a policy of "institutionalized caution,"[59] the ESA requires the federal government to conserve endangered and threatened species and to use its authority in furtherance of this goal.[60]

2. Statutory Protections

The Secretary of the Interior creates and implements recovery plans for conserving endangered and threatened species unless such plans are unnecessary.[61] The status of all listed endangered and threatened species must be monitored every five years to determine whether those species need a greater degree of protection.[62] Federal agencies are required to ensure that "any action authorized, funded, or carried out by such agenc[ies]" will not likely endanger the continued existence of protected species—unless they first obtain an exemption.[63] Federal agencies are also

54. Tenn. Valley Auth. v. Hill, 437 U.S. 153, 180 (1978).
55. 16 U.S.C. § 1531(a) (2000).
56. LIEBESMAN & PETERSEN, *supra* note 53, at 9.
57. 16 U.S.C. § 1531(b) (2000).
58. *Tenn. Valley Auth.*, 437 U.S. at 184.
59. *Id.* at 194.
60. 16 U.S.C. § 1531(c) (2000).
61. *Id.* § 1533(f)(1) (2000).
62. *Id.* § 1533(c)(2) (2000); 50 C.F.R. § 424.21 (2005).
63. 16 U.S.C. § 1536(a)(2) (2000).

authorized to acquire land to establish or support conservation programs.[64] The ESA mandates that the federal government cooperate with state and foreign governments to carry out its obligations under the Act.[65]

The ESA criminalizes acts or omissions that injure or kill threatened and endangered species or significantly impair their essential behaviors (including feeding, reproduction, and sheltering).[66] The statute specifically prohibits (1) importing or exporting any endangered species; (2) taking any such species; (3) possessing or transporting any such species within the U.S. or on the high seas; (4) selling such species within the U.S. or abroad; and (5) violating any regulation pertaining to such species promulgated by an authorized agency.[67] The Secretary of the Interior is authorized to prohibit these activities through regulation when they affect threatened species.[68]

3. What Is an Endangered or Threatened Species?

Because species classified as endangered or threatened receive the protections of the ESA,[69] understanding the meaning of those terms is important for any analysis of the statute.

The term "species" is central to all of biology, yet it is ambiguous and has no universally accepted definition.[70] A major difficulty with any definition of species is the tacit assumption that a species is a clearly-delineated group because species are really "fuzzy sets" with unclear demarcations.[71] The blurred boundary in the morphological species concept, which defines a species

64. *Id.* § 1534 (2000).

65. *Id.* §§ 1535, 1537 (2000).

66. *Id.* §§ 1532(19), 1538(a) (2000); 50 C.F.R. § 17.3 (2005).

67. 16 U.S.C. § 1538(a) (2000). Under the ESA, "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." *Id.* § 1532(19). "Harass" has been defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." 50 C.F.R. § 17.3 (2005). The FWS has defined "harm" as any action, including habitat modification or degradation, which "actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." *Id.*; Babbitt v. Sweet Home Chapter of Cmtys. for a Greater Or., 515 U.S. 687 (1995).

68. 16 U.S.C. § 1533(d) (2000).

69. *Id.* § 1533(d) (2000).

70. Paul-Michael Agapow et al., *The Impact of Species Concept on Biodiversity Studies*, 79 Q. REV. OF BIOLOGY 161, 162 (2004).

71. *Id.* at 172.

based on a set of shared physical characteristics,[72] is the variation found within populations or even within individual organisms.[73] The phylogenetic species concept, which defines a species as a group of organisms sharing at least one unique characteristic and having a common pattern of ancestry and descent,[74] breaks down at the blurred boundary of geographical distribution.[75] The biological species concept, which defines a species as a naturally interbreeding group of organisms, faces the blurred boundary of hybridization and asexual reproduction.[76]

Congress chose not to adopt any particular species concept and did not define "species" with any degree of specificity.[77] The ESA defines a "species" as any plant or animal subspecies or any interbreeding "distinct population segment" of any vertebrate species.[78] Essentially, any plant or animal population qualifies as a "species" under the definition provided by Congress.[79] However, Congress granted the Secretary of the Interior wide administrative and interpretative discretion to decide what type of populations qualify as a "species" by using any species concept

72. Rohini Balakrishnan, *Species Concepts, Species Boundaries and Species Identification: A View from the Tropics*, 54 SYSTEMATIC BIOLOGY 689, 690 (2005).

73. For example, crickets are classified by comparing the number of spines in the leg of the new specimen with the number of spines in the leg of known holotypes, or preserved sample specimens of known species. *Id.* at 689. However, the number of spines in some of the known holotypes differs between the left and right legs potentially leading to the erroneous classification of organisms belonging to the same species as organisms from different species. *Id.*

74. Agapow, *supra* note 70, at 163.

75. For instance, two groups of similar organisms can be classified as different species under the phylogenetic species concept because they occupy different geographic areas even though they could interbreed and eventually merge into a single species as recently documented between polar bears and grizzly bears. *Id.* at 172; Sara Minogue, *Strange-looking Bear is Polar-grizzly Cross*, GLOBE & MAIL (Toronto, Can.), May 11, 2006, at A11.

76. WILSON, DIVERSITY, *supra* note 1, at 38, 46-47. For example, a third of wind-pollinated Pacific oak and pine species partially interbreed producing some oak-pine hybrids but not enough to consider them a single species. *Id.* at 46-47. Another example is found in the desert-grassland whiptail lizard, an all-female species that reproduces through unfertilized eggs that undergo a chromosome doubling. Campbell, *supra* note 12, at 939.

77. LIEBESMAN & PETERSEN, *supra* note 53, at 11. In fact, Congress rejected a proposal to incorporate the biological species concept into the definitional section of the ESA. *Id.* at 12.

78. 16 U.S.C. § 1532(16) (2000).

79. LIEBESMAN & PETERSEN, *supra* note 53, at 11. The U.S. General Accounting Office even issued a report criticizing the definition as being broad enough that the squirrels in any given park could be listed as a species. *Id.* at 13. Congress ultimately admonished the listing agencies to list populations rarely and only when absolutely necessary. *Id.*

accepted by biologists.[80] For example, the amount of populations qualifying as species could be greatly limited by applying the biological species concept or greatly increased by applying the phylogenetic species concept.[81]

When defining "endangered species" and "threatened species," Congress provided a more detailed definition. An "endangered species" is a "species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest."[82] The ESA defines a "threatened species" as a "species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."[83] Since the definition of "threatened species" incorporates the definition of "endangered species," the same analysis is applied when defining whether a species is either threatened or endangered except that the danger of extinction must be present for an endangered species, but may be merely foreseeable for a threatened species.[84]

A species can be placed in danger of extinction by habitat destruction, overutilization, disease or predation, inadequate regulatory mechanisms, or other natural or man-made factors.[85] These factors are given equal weight and a finding that a single factor adversely affects a species requires the Secretary of the Interior to list the species as endangered.[86]

If any of the five factors placing a species in danger of extinction affects the species within "a significant portion of its range," then that population is entitled to protection under the ESA.[87] A majority of courts have found that a species is in danger of

80. 16 U.S.C.A. § 1533(a)-(b) (2000 & Supp. 2005); 50 C.F.R. § 424.11(a) (2005); U.S. v. Guthrie, 50 F.3d 936, 944-946 (11th Cir. 1995). *But see* Ctr. for Biological Diversity v. Lohn, 296 F. Supp. 2d 1223, 1236-40 (W.D. Wash. 2003) (finding that reliance on the biological species concept was administrative error when there was consensus that the phylogenetic species concept was appropriate). The three species concepts described above are the most widely recognized by biologists. Balakrishnan, *supra* note 72, at 689-90.

81. Agapow, *supra* note 70, at 168-70.

82. 16 U.S.C. § 1532(6) (2000).

83. *Id.* §1532(20) (2000).

84. *See* Defenders of Wildlife v. Norton, 258 F.3d 1136, 1144-45 (9th Cir. 2001) (applying the analysis for endangered species when reviewing a decision not to list a species as threatened).

85. 16 U.S.C. § 1533(1)(A)-(E) (2000); 50 C.F.R. § 424.11(c) (2005); Carlton v. Babbitt, 900 F. Supp. 526, 530 (D.D.C. 1995).

86. Nat'l Wildlife Fed'n v. Norton, 386 F. Supp. 2d 553, 558 (D. Vt. 2005).

87. *Id.* at 564.

extinction within "a significant portion of its range" when the species is no longer viable in a major geographic area where it once was viable.[88] The minority view takes a more restrictive approach and limits "a significant portion of its range" to a biologically significant area, or an area "so important to the continued existence of a species that threats to the species in that area can have the effect of threatening the viability of the species as a whole."[89] Ultimately, there is no bright line test to determine when a species qualifies for protection and each situation must be decided on an ad hoc basis.[90]

III.
THE LISTING PROCESS AND ITS EFFECT ON INSECT CONSERVATION

The process for listing potentially endangered or threatened species is the keystone of the ESA.[91] This process authorizes the Secretary of the Interior to list endangered or threatened land and freshwater species and the Secretary of Commerce to list endangered or threatened marine and anadromous species.[92] FWS and the National Marine Fisheries Service have been authorized by the Secretary of the Interior and the Secretary of Commerce, respectively, to make listing determinations.[93] Since few insect species are marine or anadromous,[94] this Article will focus on the regulatory scheme developed and implemented by the FWS.

The listing process often begins when a written listing petition is filed by a private individual; it is rarely initiated by formal agency rulemaking.[95] The agencies then review the petition, decide whether the listing is warranted or whether more information is required, and publish that decision in the *Federal Register* within statutorily mandated time periods.[96] Finally, any person may challenge any listing decision in federal court.[97]

88. *Defenders of Wildlife*, 258 F.3d at 1145; Defenders of Wildlife v. Sec'y, United States Department of the Interior, 354 F. Supp. 2d 1156, 1165 (D. Or. 2005); *Nat'l Wildlife Fed'n*, 386 F. Supp. 2d at 566.

89. Ctr. for Biological Diversity v. Norton, 411 F. Supp. 2d 1271, 1279 (D.N.M. 2005).

90. *Defenders of Wildlife*, 258 F.3d at 1143.

91. Ruhl, *supra* note 28, at 19.

92. 16 U.S.C. § 1533(a) (2000).

93. Ruhl, *supra* note 28, at 22.

94. CAMPBELL, *supra* note 12, at 614.

95. LIEBESMAN & PETERSEN, *supra* note 53, at 18.

96. 16 U.S.C. § 1533(b) (2000).

97. *Id.* § 1540(g) (2000).

This Article focuses on the effect of the two main steps of the listing process – the petition and the review – on efforts to provide ESA protection to qualifying insect species.

A. *The Petition*

Frequently, the initial step in the ESA listing process is the filing of a listing petition by an interested private person.[98] A listing petition must include the following formal requirements: (1) clear identification as a petition, (2) date, and (3) the petitioner's name, affiliation, contact information, and signature.[99] Once the FWS receives a listing petition, it must send the petitioner written acknowledgement of receipt within thirty days.[100]

The FWS must then make a finding that the petition presents "substantial scientific or commercial information indicating that the petitioned action may be warranted" within ninety days.[101] This substantial information standard requires enough information to lead a reasonable person to believe that the proposed listing is warranted.[102] No conclusive evidence of a strong likelihood of extinction is required.[103] FWS determines whether the substantial information standard is met by considering whether the petition (1) clearly indicates the proposed action; (2) provides the species' scientific and common name; (3) contains detailed data supporting the proposed action describing past and present population density, distribution, and current threats; (4) provides information about the species' status throughout its entire range or a significant portion thereof; and, (5) includes supporting documentation.[104] This regulatory scheme is necessary to prevent frivolous filings and supports the general policy of using the limited resources available to the FWS to conserve those species known to be in the greatest danger of extinction.[105]

While the petition may be filed by any interested person, the substantial information standard and the factors considered by

98. LIEBESMAN & PETERSEN, *supra* note 53, at 18.

99. 50 C.F.R. § 424.14(a) (2005).

100. *Id.*

101. 16 U.S.C. § 1533(b)(3)(A) (2000); 50 C.F.R. § 424.14(b)(1) (2005).

102. 50 C.F.R. § 424.14(b)(1) (2005); Ctr. for Biological Diversity v. Morgenweck, 351 F. Supp. 2d 1137, 1141 (D. Colo. 2004); Moden v. U.S. Fish & Wildlife Serv., 281 F. Supp. 2d 1193, 1203-04 (D. Or. 2003).

103. *Morgenwreck*, 351 F. Supp. 2d at 1141; Moden, 281 F. Supp. 2d at 1203-04.

104. 50 C.F.R. § 424.14(b)(2) (2005).

105. Listing and Recovery Priority Guidelines, 48 Fed. Reg. 43098, 43100 (Sept. 21, 1983); Nagle, *supra* note 31, at 1178, 1201.

the FWS make it hard for anyone other than an expert to successfully file a listing petition. Identifying wild specimens by scientific name is a difficult task that troubles seasoned biologists and is nearly impossible for a layperson.[106] If detailed data about population density and distribution even exists, it is hard for scientists to find—especially data about insects or any other invertebrates.[107] Only three groups may be able to file listing petitions that satisfy regulatory requirements: (1) experts with access to the relevant information, (2) experts with the ability to conduct studies to gather this information, and (3) those with the means to hire those experts.[108]

This implicit requirement of expert involvement in the petitioning step makes it harder for insects to be listed and contributes to the bias against insects.[109] Insect taxa that have a significant long-established professional following are listed more frequently than expected, while insect groups with a more limited professional following are underrepresented.[110] For instance, butterflies and moths comprise 13% of all named insect species in North America but account for 46% of all insects listed under the ESA.[111] No wasps, bees, or ants are listed even though they account for over 19% of all named insect species in North America and there has been recent concern about declining wild

106. *See* Balakrishnan, *supra* note 72, at 689 (describing problems faced by taxonomists in tropical countries when identifying species).

107. *See, e.g.*, Black, *supra* note 1, at 45 ("there has been relatively little research completed on insect ecology"); Bossart, *supra* note 35, at 87, 89 (describing descriptive data about potentially threatened or endangered insects as absent or inaccessible); Norman Myers et al., *Biodiversity Hotspots for Conservation Priorities*, 403 NATURE 853, 854 (2000) (explaining invertebrates were not considered because hardly any data exists).

108. For instance, Dr. Mark Kirkpatrick, a Professor of Zoology from the University of Texas at Austin, was the co-author of the petition requesting the listing of the Barton Springs salamander as endangered and one of the plaintiffs in the ensuing litigation. Save Our Springs v. Babbitt, 27 F. Supp. 2d 739, 741 (W.D. Tex. 1997). Similarly, the Center for Biological Diversity was the author of the petition requesting the listing of the Northern Goshawk as endangered and one of the plaintiffs in the ensuing litigation. Ctr. for Biological Diversity v. Badgley, 335 F.3d 1097, 1098-99 (9th Cir. 2003). The Center for Biological Diversity is a non-profit organization dedicated to protecting endangered species through listing under the ESA or legal action, which employs several conservation biologists dedicated to developing listing petitions. Ctr. for Biological Diversity, About the Center (2005), http://www.biologicaldiversity.org/swcbd/aboutus/factsheet.pdf; Ctr. for Biological Diversity, Staff, http://www.biologicaldiversity.org/swcbd/aboutus/index.html# (last visited May 10, 2006) (follow "Staff" hyperlink).

109. Bossart, *supra* note 35, at 86.

110. *Id.*

111. *Id.* at 84; U.S. Fish & Wildlife Service, *supra* note 34.

honeybee populations.[112] Thus, a lack of qualified entomologists to file listing petitions may be the cause of the "bias" against insects in listing decisions rather than any ESA provisions or FWS regulations.[113]

B. *The Review*

After determining that a petition presents substantial information supporting the listing of the species, FWS has until a year after the filing of the petition to review the species' status and make a final decision.[114] During this reviewing process, FWS has to determine if the species meets the statutory listing criteria and whether the threat is such that the species should receive priority over other species.[115] The agency must rely only on the "best available scientific and commercial information," without reference to the economic impact of the decision, throughout the reviewing process.[116]

1. Listing Criteria

The first phase of the reviewing process involves making a determination that the proposed species meets the statutory listing criteria. This determination requires evidence that the proposed species qualifies as a protected species as defined by the ESA and is in danger of extinction because of any of the listed factors.[117]

The statutory definition of "species" is sufficiently broad that most populations would qualify and generally does not present problems.[118] However, the definitions of "endangered species" and "threatened species" present special problems when the proposed listing involves an insect species. At this point, it is important to recall that the definition of "threatened species"

112. Gordon Allen-Wardell et al., *The Potential Consequences of Pollinator Declines on the Conservation of Biodiversity and Stability of Food Crop Yields*, 12 CONSERVATION BIOLOGY 8, 10-11 (1998); Black, *supra* note 1, at 48; Bossart, *supra* note 35, at 84; Losey & Vaughan, *supra* note 1, at 322; U.S. Fish & Wildlife Service, *supra* note 34.

113. Bossart, *supra* note 35, at 87.

114. 16 U.S.C. § 1533(b)(3)(B) (2000).

115. *Id.* § 1533(a)(1) (2000); 50 C.F.R. §§ 424.11(c), 424.14(b)(3) (2005); Listing and Recovery Priority Guidelines, 48 Fed. Reg. 43098.

116. 16 U.S.C. § 1533(b)(1)(A) (2000); 50 C.F.R. § 424.11(b) (2005); Interagency Cooperative Policy for Peer Review, 59 Fed. Reg. 34270 (July 1, 1994); Interagency Cooperative Policy on Information Standards, 59 Fed. Reg. 34271 (July 1, 1994).

117. 16 U.S.C. §§ 1532, 1533(a)(1) (2000).

118. *Supra* § II(B)(3).

incorporates the definition of "endangered species"[119] and that the definition of an "endangered species" does not extend to "a species of the Class Insecta determined by the Secretary to constitute a pest."[120] While this exclusion has been cited to describe the ESA as overtly biased,[121] no insect has ever been denied protection for this reason.[122] Thus, it cannot account for the low number of listed insects.

Similarly, the listed criteria for determining whether a species is in danger of extinction present no roadblock for the listing of insects or any other organisms. The ESA considers a species to be in danger of extinction if any of the following factors are present within its habitat or a significant portion thereof: (1) habitat destruction, (2) overutilization, (3) disease or predation, (4) inadequacy of current regulatory mechanisms, or (5) other natural or manmade factors.[123] These criteria fairly represent the leading threats to the continuing existence of all species.[124] Thus, the analysis of these factors is not likely to result in bias against insects or set a higher bar for the listing of insects than for any other species because insects are threatened by the same factors that threaten other species.[125]

2. Listing Priority Guidelines

The second phase of the reviewing process involves making a determination that the species should receive priority over other species that deserve listing. FWS decided to prioritize final list-

119. *See* Defenders of Wildlife v. Norton, 258 F.3d 1136, 1144-45 (9th Cir. 2001) (applying the analysis for endangered species when reviewing a decision not to list a species as threatened).

120. 16 U.S.C. § 1532(6) (2000).

121. Chen, *supra* note 44, at 18. While the term "pests" is not defined by the statute, it is plausible for it to include alien invasive species that have imposed agricultural and household costs of about $137 billion annually. WILSON, FUTURE, *supra* note 15, at 70-71. These alien invasive species include reptiles, mussels, and plants that could theoretically receive protection under the ESA. See *Id.* at 71-75 (listing several alien invasive species); Andrea Fanta, *Florida Tackling Creepy Problem*, BRADENTON HERALD (Fla.), Apr. 13, 2006, at 1 (detailing the effect of invasive Burmese pythons in South Florida); Brian Skoloff, *Boca Grande: Iguanas Gone Wild*, BRADENTON HERALD (Fla.), Apr. 14, 2006, at 12 (describing problems caused by invasive iguanas in South West Florida).

122. Black, *supra* note 1, at 44.

123. 16 U.S.C. § 1533(1)(A)-(E) (2000); 50 C.F.R. § 424.11(c) (2005); Carlton v. Babbitt, 900 F. Supp. 526, 530 (D.D. C. 1995).

124. *See* WILSON, FUTURE, *supra* note 15, at 50 (listing habitat destruction, invasive species, pollution, population growth, and overharvesting as the leading factors forcing species to disappear); Black, *supra* note 1, at 45-46 (same).

125. Black, *supra* note 1, at 45-46.

ing actions on a "worst-first" basis because of the limited amount of funds available for listing decisions and the large number of listing petitions.[126] These listing priority guidelines were designed to be scientifically based without regard to any perceived level of complexity among the species being compared. This contrasts with the previous listing priority guidelines, which gave priority to vertebrates and plants over insects and other invertebrates.[127]

The current listing priority guidelines comprise a tiered rubric where FWS considers first the magnitude of the threat, followed by an evaluation of the immediacy of the threat, before finally turning to a weighing of the genetic distinctiveness of the species.[128] Based on how a species ranks in each of these three categories, a number between one[129] and twelve[130] is assigned to the species.[131] Species with a priority number between one and three are proposed first and enjoy protection under the ESA, while all other species become "candidates" and receive no protection.[132]

While this system is an improvement over its predecessor, the way FWS determines the distinctiveness of a species operates in a way that biases listing decisions in favor of birds and mammals and against insects. FWS determines the genetic distinctiveness of a species by looking at the species' taxonomic classification.[133] FWS considers monotypic genera, or genera that only contain a single species,[134] as the most genetically distinct group that can

126. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43098-99 (Sept. 21, 1983); Carlton, 900 F. Supp. at 535; Scott Norris, *Only 30: A Portrait of the Endangered Species Act as a Young Law*, 54 BIOSCIENCE 288, 289 (2004).

127. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43102; LIEBESMAN & PETERSEN, *supra* note 53, at 17.

128. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43102-03 (Sept. 21, 1983); Carlton, 900 F. Supp. at 535; Friends of the Wild Swan, Inc. v. U.S. Fish & Wildlife Service, 945 F. Supp. 1388, 1391 (D. Or. 1996).

129. Representing the most distinctive species facing an imminent high magnitude threat. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43102-03.

130. Representing the least distinctive species facing a non-imminent low magnitude threat. *Id.*

131. *Id.*

132. U.S. Fish & Wildlife Service, Candidate Species (2005), http://www.fws.gov/endangered/pubs/Candidate%20Species.pdf.

133. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43099 (Sept. 21, 1983).

134. Under the Linnaean system of classification, similar species are placed in the same genus while less similar species are placed in different genera. CAMPBELL, *supra* note 12, at 469-70.

be listed under the ESA and gives them the highest priority.[135] The rationale for this decision is that monotypic genera represent unique gene pools of special scientific and educational attention.[136] Species, which are considered the next most genetically distinctive group, receive the next highest priority and subspecies receive the lowest priority because they are considered the least genetically distinct group.[137]

This priority criterion is problematic because the average number of species per genus is generally lower among birds and mammals than among insects.[138] This fact is due to the use of different taxonomic concepts and standards,[139] i.e. different species concepts, and to differing rates of evolution.[140] Through a process known as sympatric evolution, members of insect species that feed, live, and mate on one kind of plant can colonize nearby plants of a different species and within a few generations become adapted to the newly-colonized plant to the point that they can no longer survive on the original plant or reproduce with members of the source population, and thus become a separate sister species.[141] This ability to split into separate species within a short period of time places insects at a disadvantage under the current listing priority guidelines, despite the scientific and educational value of these species for the study of sympatric speciation, because it makes insects less likely to be monotypic genera entitled to higher priority.

3. Best Scientific and Commercial Data Available

When making a listing decision during the review process, the FWS is statutorily obligated to rely "solely on the basis of the

135. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43099 (Sept. 21, 1983).

136. *Id.*.

137. *Id.*

138. *Id.*

139. *Id.*

140. WILSON, DIVERSITY, *supra* note 1, at 72-73.

141. *Id.*; *e.g.* M-T Bethenod et al., *Genetic Isolation between Two Sympatric Host Plant Races of the European Corn Borer*, Ostrinia nubilalis Hübner. II: *Assortative Mating and Host-plant Preferences for Oviposition*, 94 HEREDITY 264 (2005) (sympatric speciation in corn borers); Laurence Deprés & Mehdi Cherif, *The Role of Competition in Adaptive Radiation: A Field Study on Sequentially Ovipositing Host-specific Seed Predators*, 73 J. OF ANIMAL ECOLOGY 109 (2004) (sympatric speciation on flies). *See generally* J.B. Owen, *Budding Specie – The Driver in Evolution*, 52 BIOLOGIST 170 (2005) (describing the process of sympatric evolution and evidence of its occurrence in insects and other species).

best available scientific and commercial information."[142] This standard recognizes the pre-emptive nature of the ESA and does not require conclusive evidence.[143] When there is no conclusive evidence presently available, FWS is not required to conduct the independent studies necessary to generate relevant data or resolve inconsistencies.[144] However, courts have not been consistent in explaining what the FWS must do in the event there is disagreement between scientists, with one court holding that the agency can rely on the expert of its choice and another holding that the FWS must give the benefit of the doubt to the species.[145]

Scientific and commercial data that may be considered includes scientific and trade journals, administrative reports, comments from interested parties, expert opinions, and graphical materials including maps.[146] However, FWS should not consider the decision's commercial ramifications.[147] Additionally, listing decisions may not be based on politics, the possibility of future regulatory mechanisms, or voluntary conservation efforts.[148] After relevant data is analyzed, the preliminary decision must undergo independent peer review, conducted by three experts selected by the agency, to ensure the best available data has been used.[149] When the FWS analyzes relevant published and unpublished literature, conducts peer review, and relies on the results of this analysis and review in making listing decisions, courts have upheld its decisions.[150]

Thus, a lack of available scientific and commercial data, in this case ecological entomology data, may hinder review of listing pe-

142. 16 U.S.C. § 1533(b)(1)(A) (2000); 50 C.F.R. § 424.11(b) (2005).

143. Defenders of Wildlife v. Babbitt, 958 F. Supp. 670, 679-80 (D.D.C. 1997); Ctr. for Biological Diversity v. Lohn, 296 F. Supp. 2d 1223, 1236, 1239 (W.D. Wash. 2003).

144. Sw. Ctr. for Biological Diversity v. Babbitt, 215 F.3d 58, 60 (D.C. Cir. 2000); *Lohn*, 296 F. Supp. 2d at 1236.

145. *Compare* Or. Natural Resources Council v. Daley, 6 F. Supp. 2d 1139, 1159 (D. Or. 1998) (holding that agency can rely on either expert) *with Lohn*, 296 F. Supp. 2d at 1236, 1239 (holding that agency must rely on the opinion that would grant protection to the species).

146. 50 C.F.R. §§ 424.11(b), 424.13 (2005); 59 Fed. Reg. 34271 (July 1, 1994).

147. *Id.*

148. Biological Legal Found. v. Babbitt, 943 F. Supp. 23, 25-26 (D.D.C. 1996); Or. Natural Resources Council, 6 F. Supp. 2d at 1155; Save Our Springs, 27 F. Supp. 2d at 747.

149. 59 Fed. Reg. 34270, (July 1, 1994).

150. Ctr. for Biological Diversity, 335 F.3d at 1100-01; see Northern Spotted Owl (Strix Occidentalis Caurina) v. Hodel, 716 F. Supp. 479, 483 (W.D. Wash. 1988) (rejecting FWS's decision not to list northern spotted owl after disregarding all expert opinions which supported listing the species).

titions seeking to protect endangered or threatened insects and prevent FWS from issuing listing decisions.[151] Insects with a significant traditional professional following are listed more often than expected while insects with a narrower professional following are underrepresented.[152]

Furthermore, listing petitions that satisfy regulatory requirements will prove ineffective if FWS does not have qualified experts of its own to review those petitions and determine whether the requested action is warranted.[153] This lack of available scientific data and qualified entomologists to review listing petitions and available scientific data also contributes to the problem and might be the real cause of any bias against insects in listing decisions.[154]

IV.
IMPROVING INSECT CONSERVATION

While there is minimal bias inherent in the provisions of the ESA or in regulations promulgated by the FWS, the reality of the limited protection of insects under the ESA remains. The two main problems preventing greater protection of insects under the ESA are a lack of experts to generate data for, file, and review listing petitions and FWS's consideration of a species' taxonomic classification when assigning priority numbers. These problems can be eliminated or mitigated through increased scientific knowledge about insect conservation, the incorporation of ecological significance into the regulatory guidelines for setting priority status to listing petitions, and the use of surrogate species to protect critical insect habitats.

A. *Increased Scientific Knowledge*

The main cause of the bias against insects in listing decisions is a lack of qualified biologists.[155] Qualified entomologists are required to properly identify and classify potentially endangered or

151. *See supra* § III(A) (describing the effect of available data upon entomologists and the petition process).

152. *See supra* § III(A) (describing the effect of available data upon entomologists and the petition process).

153. The lack of invertebrate experts at FWS's headquarters was partly to blame for the scarcity of insects listed under the ESA in the 1980s. Copeland Nagle, *supra* note 31, at 1196-1197.

154. Bossart, *supra* note 35, at 87.

155. *Id.*

threatened species.[156] More ecological entomologists are needed to gather detailed data about population density and distribution – especially for neglected insect groups.[157] The pool of qualified experts can be increased by providing more funding for scientific research into areas dealing with insect conservation and education about insects for the general public, scientists, and conservationists.[158]

More emphasis needs to be placed on insect ecology and taxonomy and on research addressing the 99% of species ignored by pest-control research.[159] Funding availability drives the direction of research[160] and while a dedicated source of national funding would be ideal to jumpstart research into needed areas,[161] smaller-scale programs funded by private conservation groups and research universities would be a more feasible starting point.[162] Research universities can also take the lead in increasing research funding by establishing special degree programs or endowed chairs in insect conservation.[163]

These special programs and endowed professorships could in turn lead to an increase in undergraduate and graduate courses dealing with issues related to insect conservation.[164] Exposure to this neglected area of biology would increase student interest in the field and lead to more conservation biologists capable of generating the research necessary for filing and reviewing listing pe-

156. 50 C.F.R. § 424.14(b)(2) (2005).

157. *Id.*; Bossart, *supra* note 35, at 87.

158. Black, *supra* note 1, at 46-47; Bossart, *supra* note 35, at 91; Losey & Vaughan, *supra* note 1, at 322; Van Hook, *supra* note 17, at 206-07.

159. Black, *supra* note 1, at 46; Van Hook, *supra* note 17, at 207.

160. Prachi Patel-Predd, *End of the Spectrum: The Changing Trend in U.S. Research Funding*, 21 SPECTROSCOPY 89, 89 (2006).

161. Bossart, *supra* note 35, at 91.

162. For example, both the Entomological Society of America and Harvard University provide funds for taxonomic research. Entomological Society of America, Thomas Say Award, http://www.entsoc.org/awards/professional/thomas_say.htm (last visited May 11, 2006); Harvard University Department of Organismic and Evolutionary Biology, Ernst Mayr Grant, http://www.oeb.harvard.edu/mayr_grant.htm (last visited May 11, 2006).

163. The University of California system has established a Genetic Resources Conservation Program that provides small annual grants to identify plant, animal, and microbial genetic resources and develop conservation practices. University of California Regents, Genetic Resources Conservation Program, http://www.grcp.ucdavis.edu/objectives/index.htm (last visited May 11, 2006).

164. *See* Cornell University, Insect Conservation Biology, http://instruct1.cit.cornell.edu/courses/icb344/ (last visited May 11, 2006) (describing a course on insect conservation biology); University of Delaware, Insect Conservation Ecology, https://chico.nss.udel.edu/CourseDesc (enter "ENWC315" into Course Number field and select "Search" button).

titions. Additionally, a greater understanding of insect conservation among scientists is required to increase general public awareness to the level necessary to support efforts to conserve endangered or threatened insect species.[165]

B. *Ecological Significance as a Listing Priority Criterion*

Another reason for the small number of insects listed as endangered or threatened is the FWS's decision to use monotypic genera as a proxy for genetic distinctiveness when making listing priority decisions.[166] The number of insect monotypic genera is lower than the number of bird or mammal monotypic genera because different species concepts are used to classify these types of animals and because the rate of speciation is higher among insects than among birds or mammals due to sympatric speciation.[167] The decision to include monotypic genera as a listing priority criterion makes it harder for insects to receive a high priority number.

While drafting the listing priority guidelines, the FWS considered but rejected the inclusion of ecological significance as a criterion when assigning priority rankings.[168] Instead, ecological significance would be considered on an ad hoc basis when possible but outside the formal priority system.[169] FWS reasoned that this type of information is not usually available when making listing decisions and, even if it were available, it would only affect listing priority when all of the other criteria among the species being compared were equal.[170] Additionally, FWS explained that all species had some ecological significance and the criterion could not be narrowed down to a simple yes-or-no decision.[171]

The FWS's reasoning seems accurate when one considers the state of ecological knowledge in 1983 when the listing priority guidelines were first developed; they do not make as much sense 24 years later. First, recent developments in ecology indicate that

165. Black, *supra* note 1, at 46-47; Van Hook, *supra* note 17, at 207.

166. *Supra* § III(B)(2).

167. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43099 (Sept. 21, 1983); WILSON, DIVERSITY, *supra* note 1, at 72-73.

168. Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43101. In doing so, FWS ignored comments by a Senate Committee to "place some special emphasis on protecting plants and invertebrates since they form the bases of ecosystems and food chains upon which all other life depends." *Id.* (citing S. Rep. No. 97-418, at 14 (1982)).

169. *Id.*

170. *Id.*

171. *Id.*

it is possible to make a simple yes-or-no decision when examining a species' ecological significance. In the late 1990s, the concept of "ecosystem services" developed to represent critical services that facilitate the conditions and processes sustaining human existence.[172] Ecosystem services include air/water purification, waste detoxification and recycling, soil formation and enrichment, flood control, pest control, and pollination.[173] Species facing similar threat levels could be prioritized through a simple yes-or-no decision based on whether they provide any ecosystem services.

Second, the use of ecological significance would be minimally helpful if the biased criterion of taxonomic classification is applied as well. The criterion of taxonomic classification works against insects when listing priority decisions are being made because it places a higher priority on qualities rarely found among insect species.[174] This biased criterion should be replaced by ecological significance in a system where species with a high ecological significance receive priority over species with a low ecological significance. High priority species would still be those confronting a high magnitude, imminent threat, and the most noticeable effect would be a reduction in priority rankings from twelve to eight resulting from the shift from a ternary criterion based on whether the species belongs to a monotypic genus, a polytypic genus, or is merely a subspecies to a binary criterion based on whether the species is ecologically significant or not.[175]

Finally, the idea that ecological significance is not a proper criterion because relevant information is not usually available is as unconvincing today as it was when the guidelines were developed. Elsewhere in the notice of the listing priority guidelines, FWS explained that "availability of information is implicit in any priority system" and should not be considered as a separate criterion.[176] If there is no information about a species' ecological significance, then that criterion is not met and the species should receive a lower priority just as if there is no information indicating the threat(s) to the species is imminent.

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172. WILSON, *supra* note 15, at 106; James Salzman et al., *Protecting Ecosystem Services: Science, Economics, and Law*, 20 STAN. ENVTL. L.J. 309, 310 (2001).

173. *Id.*

174. *Supra* § III(B)(2).

175. See Listing and Recovery Priority Guidelines, 48 Fed. Reg. at 43103 (illustrating the listing priority scheme in a table).

176. *Id.* at 43099.

C. *Surrogate Species*

Potential petitioners can avoid the problems created by the lack of information concerning insect conservation[177] and the inherent bias of the listing priority guidelines by focusing their efforts on surrogate species. Surrogate species are species used as "umbrellas" to protect other species occurring within the same geographical area.[178] The term "surrogate species" actually encompasses different types of species classified according to certain characteristics that influence their value as surrogate species.[179] For instance, some surrogate species have high charisma due to significant public appeal or are well-studied and most of their history and ecology is known.[180]

Surrogate species are important because listing a single surrogate species can effectively protect an entire area and its species against habitat destruction, the second most destructive threat to endangered or threatened species.[181] Petitioners can take advantage of the second purpose of the ESA, the protection of endangered or threatened species' ecosystems, by seeking the protection of surrogate species to benefit other species inhabiting the same area.[182] Filing a listing petition for the protection of any species within an ecosystem blocks the area from any potential development at least until a decision not to list the species is made.[183] For example, anecdotal evidence suggests that due to the listing of the Mission Blue butterfly, all other species inhabiting San Bruno Mountain in northern California have been protected from habitat destruction as well.[184]

However, most petitioners fail to take advantage of this strategy[185] because the lack of supporting evidence has made the use

177. Sandy J. Andelman & William F. Fagan, *Umbrellas and Flagships: Efficient Conservation Surrogates or Expensive Mistakes?*, 97 PROC. NAT'L ACAD. SCI. 5954 (2000).

178. Christopher J. Betrus et al., *Cross-taxonomic Potential and Spatial Transferability of an Umbrella Species Index*, 74 J. ENVTL. MGMT. 79, 79 (2005); T.M. Caro & Gillian O'Doherty, *On the Use of Surrogate Species in Conservation Biology*, 13 CONSERVATION BIOLOGY 805, 806 (1999); Jean-Michel Roberge & Per Angelstam, *Usefulness of the Umbrella Species Concept as a Conservation Tool*, 18 CONSERVATION BIOLOGY 76, 77 (2004).

179. Andelman & Fagan, *supra* note 177, at 5955.

180. *Id.*

181. WILSON, FUTURE, *supra* note 15, at 50; Wilcox & Elderd, *supra* note 35, at 556.

182. 16 U.S.C. § 1531(b) (2000); Wilcox & Elderd, *supra* note 35, at 552.

183. Wilcox & Elderd, *supra* note 35, at 552.

184. *Id.* at 556-57.

185. *Id.* at 556.

of surrogate species controversial.[186] But recent scientific studies have shown that the conservation of surrogate species can provide some protection to insect species[187] despite their apparent general ineffectiveness in protecting other species inhabiting the same area when measured against non-surrogate species.[188] A 2004 study of the usefulness of surrogate species for the conservation of species showed that four out of six previous studies had demonstrated that surrogate species are useful at protecting insect species.[189] An earlier study found that protection of species living in or near aquatic habitats and species with narrowly-defined habitat needs trickled down to other species inhabiting the same ecosystems.[190] A separate study also found that the conservation of species with narrowly-defined habitat needs protects insect species with similar needs.[191]

The use of surrogate species to protect other endangered or threatened species has also been criticized because it could lead to the protection of ecosystems lacking any other species deserving protection.[192] This objection is faulty because it rests on the assumption that the primary goal of the ESA is protecting the greatest number of species possible at the expense of other objectives, including the maintenance of the greatest variety of biodiversity and maintaining ecosystem around the world.[193] When Congress enacted the ESA, it was concerned about the extinction of any species, not just those which inhabit ecosystems with many other species on the brink of extinction.[194]

It seems, then, that the best available scientific data indicates that using surrogate species can effectively protect threatened or endangered insect species. Therefore, petitioners should not fear using surrogate species to protect insect species because the concept has been tested and there is evidence indicating that it can

186. Betrus, *supra* note 178, at 79.

187. *See, e.g.*, Betrus, *supra* note 178, at 85 (birds and butterflies); Petri Martikainen et al., *Threatened Beetles in White-Backed Woodpecker Habitats*, 12 CONSERVATION BIOLOGY 293 (1998) (woodpeckers and beetles).

188. Andelman & Fagan, *supra* note 177, at 5957-58.

189. Roberge & Angelstam, *supra* note 178, at 80.

190. Andelman & Fagan, *supra* note 177, at 5957.

191. Martinaiken et al., *supra* note 187, at 299.

192. Nagle, *supra* note 31, at 1251.

193. Peter Kareiva & Michelle Marvier, *Conserving Biodiversity Coldspots*, 91 AM. SCI. 344, 346 (2003).

194. Tenn. Valley Auth. v. Hill, 437 U.S. 153, 177 (1978).

be effective.[195] After all, the ESA itself "gives the benefit of the doubt to the species."[196]

V.
CONCLUSION

The ESA is "the most important conservation law in the history of the United States."[197] The longer it protects a species, the greater the likelihood of that species not going extinct.[198] Species on the brink of extinction should be listed under the ESA as soon as possible to improve their chances of survival.[199] Yet, while the rate of extinction is the same for insects and other animals, insects are underrepresented in the FWS's list of threatened or endangered species.[200]

Insects play an indispensable role in our lives. Insects are so ecologically important that their disappearance would sound the death knell for many other species, including our own.[201] The economic cost of the disappearance of just a few insect species within the United States would amount to almost $60 billion.[202] Insect biodiversity could yield valuable materials that could revolutionize agriculture and medicine.[203] Insect conservationists have argued that the ESA and the FWS are biased against insects, despite the importance of insects in our lives.[204]

The reality, however, is that there is very little bias inherent in the provisions of the ESA or in regulations promulgated by the FWS. The bias inherent in the ESA listing procedures is created by the FWS's decision to use monotypic genera as a proxy for genetic distinctiveness when making listing priority decisions.[205] This bias could be corrected if FWS would incorporate ecological significance as a priority criterion instead of genetic distinctive-

195. Roberge & Angelstam, *supra* note 178, at 83.

196. *See* Ctr. for Biological Diversity v. Lohn, 296 F. Supp. 2d 1233, 1239 (W.D. Wash. 2003) (citing Conner v. Burford, 848 F.2d 1441, 1454 (9th Cir. 1988)).

197. WILSON, FUTURE, *supra* note 15, at 185.

198. Martin F.J. Taylor et al., The *Effectiveness of the Endangered Species Act: A Quantitative Analysis*, 55 BIOSCIENCE 360, 361 (2005).

199. *Id.* at 366.

200. U.S. Fish & Wildlife Service, *supra* note 38.

201. DIVERSITY, *supra* note 1, at 133.

202. Losey & Vaughan, *supra* note 1, at 312.

203. *See* WILSON, FUTURE, *supra* note 15, at 114-28 (describing bioprospecting of biodiversity for use in genetic engineering and medicine).

204. Black, *supra* note 1, at 44; Nagle, *supra* note 31, at 1194, 1197.

205. *Supra* § III(B)(2).

ness,[206] but this is unlikely to happen because of FWS's reluctance to change its approach to implementation.[207]

Despite the potential bias created by the use of genetic distinctiveness as a listing criterion, the main cause of the low number of insect species listed under the ESA is a lack of qualified biologists.[208] Qualified biologists are required to properly identify and classify potentially endangered or threatened species[209] and to gather the detailed data about population density and distribution necessary to file and review listing petitions.[210]

This problem can be solved by placing more emphasis on insect ecology and taxonomy.[211] Small-scale programs funded by private conservation groups and research universities would be a feasible starting point leading to an increase in college courses dealing with issues related to insect conservation. In turn, exposure to this neglected area would result in more conservation biologists capable of generating the research necessary for filing and reviewing listing petitions and increasing general public awareness to the level necessary to support efforts to conserve insect species.[212] Until sufficient information about insect conservation is available, petitioners could use surrogate species to protect threatened or endangered insect species.[213]

In light of FWS's reluctance to change, the best solution to the problem is an increase in knowledge about insect conservation and the use of surrogate species to protect endangered and threatened species until the necessary knowledge base has been established. Conservationists, scientists, and interested groups cannot sit with crossed arms, failing to take advantage of the ESA. Denying deserving insects the protections of the ESA, through bias or inaction, would be antithetical to the ESA's stated purpose of conserving any endangered and threatened species.[214]

206. *Supra* § IV(B).
207. Norris, *supra* note 126, at 291.
208. Bossart, *supra* note 35, at 87.
209. 50 C.F.R. § 424.14(b)(2) (2005).
210. 50 C.F.R. § 424.14(b)(2) (2005); Bossart, *supra* note 35, at 87.
211. *Supra* § IV(A).
212. Black, *supra* note 1, at 46-47; Van Hook, *supra* note 17, at 207.
213. *Supra* § IV(C).
214. *See supra* § II(B)(1).