BRIDGING THE DIVIDE: THE ROLE OF SCIENCE IN SPECIES CONSERVATION LAW

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This Article posits that there is currently a disjunction between the disciplines of environmental law and environmental science that will operate to thwart an effective species conservation policy scheme. It argues that an effective conservation paradigm must acknowledge the uncertainty inherent in science and foster an interdisciplinary, wholly informed approach that can be implemented in a flexible manner. The recommendation is based first on a thorough examination of the fundamental nature of science and the public misperception of its omniscience. The author further discusses the role of science in the statutory scheme of the Endangered Species Act, particularly its best available science mandate. The Article recommends instead a more dynamic and complete analytic framework, and concludes with a review of the 2001 Klamath Basin controversy and how that event illustrates both the pitfalls of adhering to conceptions of "sound science" and the need for a new approach to species conservation policy and the role of science therein.

TABLE OF CONTENTS

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> Is it still like the story of Genesis—still just at the beginning—or more like a reverse kind of Noah's Ark, with more and more being told to get off the ship?[1]

I. Introduction

Ecosystems worldwide hang in precarious balance. Habitat is being destroyed without apology,[2] and the rate of species extinction is 100 per

[1] Rick Bass, Caribou Rising 154 (2004).

[2] Most biologists, Congress, and the Supreme Court all agree that the number one reason for species extinction is habitat loss. Tenn. Valley Auth. v. Hill, 437 U.S. 153, 179 (1978) ("Congress started from the finding that '[t]he two major causes of extinction are hunting and destruction of natural habitat.' . . . Of these twin threats, Congress was informed that the greatest was destruction of natural habitats.") (citations omitted). Habitat destruction in this country has been a function of our historical commitment to industrialization and "progress."

> The history of this nation's natural resources programs is a saga of single-minded

day and rising.[3] Slowing the rates of species extinction and ecosystem destruction is vital to preserving the Earth's biodiversity.[4] It is our generation that will determine the ultimate fate of these ecosystems and the species that depend on them; and we must act now, before it is too late.[5]

An effective conservation scheme requires a fusion of cutting-edge environmental science and environmental law. Currently, however, there exists a profound disconnect between these two disciplines.[6] We must bridge this

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> exploitation underwritten, even today, by free public land, royalty free mining, below-cost federal water, below-cost timber sales, below-cost grazing fees, below-cost hydropower, construction-cost-free navigation and ninety percent federal highway construction monies, a federal welfare system whose aggregate provides multi-million dollar subsidies for companies the size of Del Monte and Weyerhaeuser, American Metals Climax and American Trucking Association, an encouragement to continue to use natural resources in ways that are not only inefficient and destructive but that are no longer even sustainable.

Oliver A. Houck, *Of Bats, Birds and B-A-T: The Convergent Evolution of Environmental Law*, 63 MISS. L.J. 403, 434–35 (1994). *See also* Staff & Wire Reports, *Congress Takes Aim at Endangered Species Act*, CASPER STAR TRIB., Nov. 30, 2004, *available at* http://www.casperstartribune.net/articles/2004/11/30/news/wyoming/a0833c9d8837336e87256f5c001d5675.txt.

[3] Tim W. Clark, *A Course on Species and Ecosystem Conservation: An Interdisciplinary Approach*, *in* YALE SCH. OF FORESTRY & ENVTL. STUDIES, BULLETIN SERIES NO. 105, SPECIES AND ECOSYSTEM CONSERVATION: AN INTERDISCIPLINARY APPROACH 17, 33 (Tim W. Clark et al. eds., 2001).

[4] *Id. See also* Walter V. Reid, *Ecosystem Data to Guide Hard Choices*, ISSUES IN SCI. & TECH. ONLINE, Spring 2000, http://www.issues.org/issues/16.3/reid.htm (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review) ("Reactive management was inevitable when ecological knowledge was insufficient to allow more reliable predictions. Today . . . human welfare is utterly dependent on forward-looking and integrated management decisions."). The benefits of biodiversity have been expounded upon by a great many authors. For example, in his book *The Diversity of Life*, world-renowned scientist and conservationist E. O. Wilson comments:

> Recent experimental studies on whole ecosystems support what was long suspected: in most cases, the more species living in an ecosystem, the higher its productivity and the greater its ability to withstand drought and other kinds of environmental stress. Since we depend on an abundance of functioning ecosystems to cleanse our water, enrich our soil, and manufacture the very air we breathe, biodiversity is clearly not an inheritance to be discarded carelessly.

E. O. Wilson, THE DIVERSITY OF LIFE xxiii (2d ed. 1999).

[5] Clark, *supra* note 3, at 20. *See also* ANN P. KINZIG ET AL., NATURE AND SOCIETY: AN IMPERATIVE FOR INTEGRATED ENVIRONMENTAL RESEARCH 4 (2000), *available at* http://stephenschneider.stanford.edu/Publications/PDF_Papers/NSFReport.pdf (noting the environmental foundation upon which America's economic prosperity rests is threatened).

[6] *See* J. B. Ruhl, *The Battle Over Endangered Species Act Methodology*, 34 ENVTL. L. 555, 573–75 (2004) (outlining the numerous mismatches between the ESA's legal questions and corresponding scientific questions). For a parallel discussion of the mismatch between science and the workings of our legal system, see Michael J. Brennan et al., *Square Pegs and Round Holes: Application of the "Best Scientific Data Available" Standard in the Endangered Species Act*, 16 TUL. ENVTL. L.J. 387, 393 (2003):

> A prevailing [scientific] paradigm extends over time, informing and being informed by the experiments in which it is involved and by new knowledge learned. Some-

divide if we are successfully to meet the challenges of natural resource conservation in the twenty-first century and beyond.

The disjunction between environmental science and environmental law manifests itself in several ways. First, as this Article will demonstrate, environmental law often demands "far more specificity from science than it is able to deliver."[7] While environmental law should remain rooted in science, lawmakers must understand and provide for the data gaps and uncertainties that characterize science in general, and ecosystem-based science in particular.

Secondly, environmental law remains fragmented and disciplinary. Water law is treated separately from endangered species law, which is treated separately from air quality law. Such piecemeal treatment is out of step with the prevailing scientific approach to understanding complex, dynamic, interconnected ecosystems. Further, while scientists theoretically embrace an ecosystem approach, they too remain narrowly focused on their specific disciplines. While environmental law should remain rooted in science, natural resource managers should acknowledge that management decisions are inherently multidisciplinary and should commit to moving toward a more comprehensive approach.[8]

Unfortunately, our current conservation paradigm does not foster an interdisciplinary, deliberate, and wholly informed approach to conservation. Thus, we must develop a new process, one that bridges traditional

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times the paradigm grows and flourishes and sometimes it is replaced by something revolutionary. But it is expected that there will be an extension through time as knowledge informs and modifies. The legal system, on the other hand, imposes brief windows of time defined by the rules of evidence applicable to a particular matter needing resolution such as a rulemaking or litigation. In this sense, scientific knowledge is like an endless movie in which one is never sure where one has entered the theater. The legal system, however, takes a single or discrete window of frames and tries to discern the entire plot.

[7] Houck, *supra* note 2, at 414.

[8] In addition to biology and ecology, natural resource managers should look to law, economics, political science, and sociology. *See* Tim W. Clark et al., *Leadership in Species and Ecosystem Conservation*, *in* YALE SCH. OF FORESTRY & ENVTL. STUDIES, BULLETIN SERIES NO. 105, SPECIES AND ECOSYSTEM CONSERVATION: AN INTERDISCIPLINARY APPROACH 9, 10 (Tim W. Clark et al. eds., 2001) [hereinafter *Leadership*]. *See also* Louise Lasley, *Welcome to Readers*, *in* YALE SCHOOL OF FORESTRY & ENVIRONMENTAL STUDIES, BULLETIN SERIES NO. 105, SPECIES AND ECOSYSTEM CONSERVATION: AN INTERDISCIPLINARY APPROACH 5 (Tim W. Clark et al. eds., 2001); Wendy E. Wagner, *Congress, Science, and Environmental Policy*, 1999 U. ILL. L. REV. 181, 268; Stephen Breyer, *Science in the Courtroom*, ISSUES IN SCI. & TECH. ONLINE, Summer 2000, http://www.issues.org/issues/16.4/breyer.htm (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review) (commenting on the need for legal experts to become versed in science, and the corresponding need for scientists to become versed in law); KINZIG ET AL., *supra* note 5, at 1; Reid, *supra* note 4. Tim Clark has advocated a three-pronged approach to interdisciplinary education for conservation biology professionals, which includes the teaching of "an interdisciplinary, 'procedural rationality' for analyzing problems and evaluating potential solutions." Tim W. Clark, *Developing Policy-Oriented Curricula for Conservation Biology: Professional and Leadership Education in the Public Interest*, 15 CONSERVATION BIOLOGY 31, 31 (2001) [hereinafter *Policy-Oriented Curricula*].

disciplinary divides in a "deliberate search for the maximization of valued goals."[9] Conservation issues are too spatially and temporally complex for any one discipline to resolve.[10] While a successful conservation regime must build upon a solid scientific foundation, a wholly informed process, by definition, must be ecosystem-based, interdisciplinary in nature, and flexible in implementation.

To understand exactly why such a science-based, holistic approach is needed, it is important to understand where we are today, how we got there, and what alternatives are available to us as we move forward into the twenty-first century. In this Article, I start out by discussing science: what it is, what it can do, and how it is perceived in our society. I next discuss the current role of science in environmental law, specifically the best available science mandate of the Endangered Species Act (ESA).[11] After discussing the shortcomings of the way science is used in the current ESA, I discuss alternative ways that scientific understanding can be incorporated into species conservation law. Finally, I use the 2001 Klamath Basin crisis to demonstrate the urgent need for a new holistic, ecosystem-based, interdisciplinary, and flexible approach to natural resource management.

II. On Science

A. *What* Is *Science?*

Before embarking on a discussion of the role of science in environmental law, we must ask ourselves one basic question: what exactly *is* science anyway? Our modern, technologically reliant society dramatically misperceives what science is and what it is capable of doing. Scientists are not—nor will they ever be—omniscient. Instead of pretending that scientific uncertainty can be overcome with more and better research, we must acknowledge that uncertainty is unavoidable and learn how best to incorporate it into our decision-making process.[12] This is especially true

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[9] Steven A. Primm & Tim W. Clark, *Making Sense of the Policy Process for Carnivore Conservation*, 10 Conservation Biology 1036, 1041 (1996); Tim W. Clark, *Interdisciplinary Problem Solving in Species and Ecosystem Conservation*, *in* Yale Sch. of Forestry & Envtl. Studies, Bulletin Series No. 105, Species and Ecosystem Conservation: an Interdisciplinary Approach 35, 38 (Tim W. Clark et al. eds., 2001).

[10] Primm & Clark, *supra* note 9, at 1044.

[11] 16 U.S.C. §§ 1531–1544 (2005).

[12] Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn't Always Better Policy*, 75 Wash. U. L.Q. 1029, 1036 (1997). *See also* Mary H. Ruckelshaus et al., *The Pacific Salmon Wars: What Science Brings to the Challenge of Recovering Species*, 33 Ann. Rev. Ecological Sys. 665, 693 (2002) ("Uncertainty, lack of basic ecological understanding, and tremendous environmental variability make [predicting species population dynamics precisely and accurately] fruitless. But we can identify management actions that are likely to yield marked improvements in population status under a wide variety of scenarios."); Wagner, *supra* note 8, at 187 n.25 ("Because [of] our

in an ecosystem context, where the systems within which scientists must act are complex and decisions must often be made based on incomplete data.[13]

B. Basic Versus Applied Science

The sciences can be distinguished from each other in many ways. One of the most important distinctions is between basic science and applied sciences.[14] Basic and applied science have very different aims and methodologies.[15] Basic sciences include the hard sciences, such as chemistry and physics, and are primarily concerned with experimentation and hypothesis testing. Applied sciences, such as wildlife biology and ecosystem science, tend to be more field-based and are more concerned with taking what knowledge we have and applying it to solve real-world problems. While basic science often provides the foundation for applied science, it is not a valid substitute.[16]

1. Basic Science

Basic science uses the scientific method to discover functional relationships that enable scientists to make precise and accurate predictions.[17] These functional relationships are objective, universal, and context- and viewpoint-independent.[18] Functional relationships become generally accepted by the scientific community at large only after repeated testing and intense scrutiny.[19]

Experiments, particularly those performed in laboratories, are the preferred means of testing in the basic science context because they can

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present lack of scientific knowledge . . . we are condemned to . . . regulating . . . 'through a glass darkly.'") (citing CARL F. CRANOR, REGULATING TOXIC SUBSTANCES: A PHILOSOPHY OF SCIENCE AND THE LAW 11 (1993)).

[13] Ronald D. Brunner & Tim W. Clark, *A Practice-Based Approach to Ecosystem Management*, 11 CONSERVATION BIOLOGY 48, 54 (1997).

[14] A. Dan Tarlock identifies a third type of science, regulatory science, unique to the environmental realm:

> Regulatory science is a new form of applied science driven by the need to provide scientific answers to causal questions implicit in modern environmental regulatory programs. This challenges scientists because the issues are framed by legislatures and regulators and force the scientific community to adapt its processes and protocols of inference and proof to answer them.

A. Dan Tarlock, *Who Owns Science?*, 10 PENN. ST. ENVTL. L. REV. 135, 145–46 (2002).

[15] Brunner & Clark, *supra* note 13, at 52.

[16] *Id*.

[17] *Id.* (citing M. Friedman, *The Methodology of Positive Economics*, *in* ESSAYS IN POSITIVE ECONOMICS 3–43 (1953)).

[18] *Id*.

[19] *Cf.* Brunner & Clark, *supra* note 13, at 52.

control for confounding variables.[20] This degree of control enables other scientists to repeat the experiment and test the hypothesis, which in turn provides additional evidence with which to support or refute a scientist's conclusions. This rigorous peer review furthers the scientific process because it increases the likelihood that substantive methodological flaws will be revealed.[21]

2. *Applied Science*

While basic science has served as a model for the applied sciences,[22] it is inapposite in the ecological realm for numerous reasons.[23] Nature cannot serve as a controlled laboratory environment: there are multiple known and unknown confounding variables; these variables interact with each other in unknown and unknowable ways; and exact circumstances (e.g., habitats, community dynamics, climate conditions, and ecosystem functions) are impossible to recreate or replicate.[24] Further, large-scale field experiments can be prohibitively expensive, practically difficult, and precluded by ethical considerations.[25]

Since controlled experiments are seldom feasible in the field, conservation and wildlife biologists often engage in observational studies.[26] Observing natural phenomena is less costly and provides more spatial and temporal flexibility than controlled experimentation.[27] Ethical considerations are not implicated to the same extent in observational studies as in field and laboratory experiments.[28] However, observational studies do not permit the same degree of control or replication as laboratory ex-

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[20] Doremus, *supra* note 12, at 1059.

[21] Lars Noah, *Scientific "Republicanism": Expert Peer Review and the Quest for Regulatory Deliberation*, 49 Emory L.J. 1033, 1047 (2000). *See also* Brian Scott Pasko, Comment, *The Great Experiment that Failed? Evaluating the Role of a "Committee of Scientists" as a Tool for Managing and Protecting Our Public Lands*, 32 Envtl. L. 509 (2002) (discussing the National Forest Management Act's requirement of a "Committee of Scientists" and concluding that small, local committees of scientists should be created to review managers' decisions and guide public land management).

[22] Brunner & Clark, *supra* note 13, at 52.

[23] "The elegant experiment, clear hypothesis, and simple model are icons of good science. But when science enters the arena of endangered species recovery, the science is rarely elegant, clear, or simple." Ruckelshaus et al., *supra* note 12, at 696.

[24] Brunner & Clark, *supra* note 13, at 52; Doremus, *supra* note 12, at 1060.

[25] Doremus, *supra* note 12, at 1060.

[26] *Id.* Conservation biologists' studies often focus on "applied problems such as loss of genetic diversity, loss of species diversity and loss of diversity in ecosystems." Jory Ruggiero, *Toward a Law of the Land: The Clean Water Act as a Federal Mandate for the Implementation of an Ecosystem Approach to Land Management*, 20 Pub. Land & Resources L. Rev. 31, 38 (1999) (citing Reed F. Noss & Allen Y. Cooperrider, Saving Nature's Legacy: Protecting and Restoring Biodiversity 84 (1994)).

[27] Doremus, *supra* note 12, at 1060.

[28] *Id.* For example, "it might be illegal or immoral to introduce a pathogen to an island ecosystem, or to remove all members of a species from that ecosystem." *Id.* Scientists can, however, *observe* the effects of a pre-existing disease on a species, or the ecological ramifications of local extinctions, without implicating the same ethical concerns.

periments.[29] To compensate for this shortcoming, field biologists rely on statistical tests[30] to measure the significance or reliability of their results.[31]

In recent years, applied scientists have also come to rely on computer models to simulate natural systems.[32] Models allow researchers to manipulate simplified versions of natural systems in numerous ways and observe predicted impacts over large spatial or temporal scales.[33] While the reliability of computer models continues to improve, models cannot yet simultaneously represent systems precisely (i.e., with quantitative accuracy), realistically (i.e., with qualitative accuracy), and with generality (i.e., across a broad range of system behaviors).[34] Thus, models are better understood as a tool that can be used to help decision-makers make informed choices rather than as an infallible means of providing the one "right solution" to an environmental problem.[35]

The complexity of natural systems means that regardless of which data collection and analysis methods are used, scientists inevitably face data gaps and uncertainties as they try to predict consequences of alternative courses of action.[36] Conservation biologists and other applied environmental scientists must integrate general scientific knowledge with context-specific information and make their best scientific judgment as to what is an appropriate course of action in a particular situation.[37] Applied science is thus pragmatic, but not "scientific" per the basic science-hard science paradigm.[38]

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[29] *Id.*

[30] For a detailed discussion on the role of statistics in environmental law, see David E. Adelman, *Scientific Activism and Restraint: the Interplay of Statistics, Judgment, and Procedure in Environmental Law*, 79 Notre Dame L. Rev. 497 (2004).

[31] Doremus, *supra* note 12, at 1070. By convention, scientists generally use a 95% level of significance to determine whether a result is meaningful. *Id*. at 1071.

[32] *See, e.g.*, Steven L. Peck, *Ecological Modeling: A Guide for the Nonmodeler*, 2 Conservation in Practice 36 (Fall 2001) (describing ecological modeling processes).

[33] Doremus, *supra* note 12, at 1061.

[34] *Id.* Because of the inherent limitations of modeling, courts have required agencies to "explain the assumptions and methodology used in preparing [a] model and, if the methodology is challenged, . . . provide a complete analytic defense." Brennan et al., *supra* note 6, at 431 (citing United States Air Tour Ass'n v. Fed. Aviation Admin., 298 F.3d 997, 1008 (D.C. Cir. 2002) (quoting Small Refiner Lead Phase-Down Task Force v. United States Envtl. Prot. Agency, 705 F.2d 506, 535 (D.C. Cir. 1983))).

[35] Peter S. Adler et al., Managing Scientific and Technical Information in Environmental Cases: Principles and Practices for Mediators and Facilitator 18, http://www.resolv.org/pubs/envir_wjc.pdf (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review). (The phrase "right solution" is the author's and is not attributable to Adler et al.) Scientific experts employed by different interest groups may bring different models to the table, each of which might point to a radically different solution or answer to the problem at hand. *Id.* at 19. *See also* Brennan et al., *supra* note 6, at 432 (noting that different "forms of models have their supporters and detractors"); Ruckelshaus et al., *supra* note 12, at 690 (calling for use of better models in making management decisions).

[36] Brunner & Clark, *supra* note 13, at 52.

[37] *Id.*

[38] *Id.*

C. Procedural Versus Substantive Science: There Is No "One Truth"

At its procedural core, science is a way of gathering, synthesizing, and analyzing information about the world.[39] Through the scientific method, a scientist systematically gathers data; communicates to his peers his methodology, results, conclusions, and uncertainties; receives criticisms of his work from the relevant scientific community; and then responds to this criticism.[40] Rather than seeking the definitive "one truth," science approaches an understanding of the natural world through a continual process of experimentation.[41] It is this procedure, the scientific process, which lends credibility to the substantive science.

Substantive science is the body of knowledge produced by the scientific method.[42] The more a hypothesis is tested and holds (i.e., the more evidence that builds in favor of any given hypothesis), the more acceptable it becomes to the scientific community at large.[43] However, scientists are always looking for ways to refute hypotheses, no matter how well-supported. Thus, any scientific consensus remains perpetually tentative: "[t]oday's conclusions are always subject to re-evaluation and modification in light of tomorrow's new evidence."[44] Science is ever-evolving and at best only supports various hypotheses or theories.[45] In science, nothing is ever proven; the "one truth" does not exist; and we will sometimes—inevitably—be wrong.[46]

Since there is no "one truth" in science, every scientific conclusion involves an informed judgment.[47] Reliance on science, then—especially in the environmental realm, where decisions often push the limits of scientific understanding—necessarily involves reliance on empirically informed

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[39] Doremus, *supra* note 12, at 1057.

[40] *Id*.

[41] Tarlock, *supra* note 14, at 139.

[42] *See* Doremus, *supra* note 12, at 1057.

[43] *Id. See also* Edward T. Dangel, III, *Proof of Causation in Toxic Tort Cases*, 74 MASS. L. REV. 169, 169 (1989) ("The scientific method utilizes experimentation, observation and repetition.").

[44] *Id.*

[45] A theory is simply a hypothesis supported by a large body of evidence.

> [A]t some level, all scientific theories are uncertain because they cannot be definitively proved or disproved. Science thus does not consist of mechanical true-false testing, but must turn on the degree of confidence a hypothesis warrants based on whether it has withstood (or failed) rigorous testing. Further, scientific testing itself entails auxiliary hypotheses and background knowledge, both of which will vary in the degree to which they are corroborated. . . . [S]cience is "a process rather than the product of inquiry."

Adelman, *supra* note 30, at 531 (quoting RICHARD H. GASKINS, BURDENS OF PROOF IN MODERN DISCOURSE 152–53 (1992)).

[46] Robert W. Adler, *The Supreme Court and Ecosystems: Environmental Science in Environmental Law*, 27 VT. L. REV. 249, 347–48 (2003).

[47] Doremus, *supra* note 12, at 1063.

judgments.[48] With reference to endangered species conservation, these informed judgments represent the best available science; as such, managers are justified in relying on them when making natural resource management decisions.[49]

In the conservation context, as in any scientific context, it makes more sense to rely upon the professional judgments of scientists than the educated guesses of policymakers or laymen when it comes to evaluation of the available evidence.[50] Scientists are more likely to have the requisite background knowledge against which to assess and evaluate data and theories.[51] Over the years, scientists develop unique skills of observation and analysis; they learn how to distinguish the reliable from the unreliable, the probable from the improbable.[52] Further, scientists generally interpret data conservatively, and take care not to allow personal biases to affect their professional judgment.[53]

Thus, the scientific processes engaged in by applied scientists—even if those processes are limited and observational—are grounded in empirical evidence and are quite sound. Persuading the public to accept the limitations inherent in applied scientific processes, however, takes time and requires that people understand what science is and how the scientific method operates.[54]

D. Scientific Illiteracy

1. The State of the Union

Ensuring that Americans understand what science is and how the scientific method operates is easier said than done. The American public, as a whole, is overwhelmingly scientifically illiterate.[55] "Studies done in the

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[48] *Id.* at 1064; Tarlock, *supra* note 14, at 140–41. The Supreme Court has endorsed this approach in a related context: "[i]t is not infrequent that the available data do not settle a regulatory issue, and the agency must then exercise its judgment in moving from the facts and probabilities on the record to a policy conclusion." Noah, *supra* note 21, at 1073.

[49] Doremus, *supra* note 12, at 1064. In the interest of full disclosure, scientists should be frank and explain how both scientific evidence and judgment calls informed their conclusions. Tarlock, *supra* note 14, at 145.

[50] Doremus, *supra* note 12, at 1072.

[51] *Id.*

[52] *Id.*

[53] *Id.* at 1074.

[54] Carl N. McDaniel, *The Human Cost of Ideology as Science*, 18 CONSERVATION BIOLOGY 869, 871 (2004).

[55] For example, "Although Americans are highly supportive of [science and technology], their knowledge is limited. Many people do not seem to have a firm understanding of basic scientific facts and concepts. Experts in science communication encounter widespread misunderstanding of how science works. Moreover, surveys conducted by the National Science Foundation (NSF) and other organizations show minimal gains over time in the public's knowledge of science and the scientific method." NAT'L SCI. BD., SCIENCE & ENGINEERING INDICATORS 1–5 (2004), *available at* http://www.nsf.gov/statistics/seind04. *See also* Daniel J. Rohlf & David S. Dobkin, *Legal Ecology: Ecosystem Function and the*

1980s and 1990s consistently revealed that approximately ninety percent of the American public lacks a working knowledge of [elementary] science."[56] The lay public understands neither the scientific process itself nor what certainty science is capable of providing.

Yet, the American public—rather than demanding that the "black box" of science be opened for them[57]—in many instances continues to engage in a kind of science-worship.[58] There are several reasons for this blind faith: science continually increases our creature comforts;[59] the media sings the praises of scientific accomplishments (while neglecting to mention corresponding scientific limitations);[60] science is secular rather than sectarian; and science appears to be an objective means for achieving the truth, untainted by politics and policy.[61] In the conservation context, the public may adopt an "ignorance is bliss" mentality, preferring to believe that science can solve environmental problems rather than owning up to the difficult social issues underlying those problems.[62] As one scholar suggests, "[b]ecause environmental problems often bring quality of life issues and decisions about future generations into stark contrast with immediate monetary interests, resolving environmental issues often requires unpleasant or even tragic decisions that involve painful personal or societal sacrifice."[63]

Americans' faith in science is not absolute, however. The recent manipulation of science by special interests has made the public increasingly suspicious of policy decisions made in the name of science.[64] The in-

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Law, 19 Conservation Biology 1244 (2005) ("Ecological illiteracy . . . also eventually results in policymakers and judges who are similarly ill-equipped to write laws or decide disputes that involve these [ecological] issues.").

[56] Wagner, *supra* note 8, at 225 (citing Nat'l Sci. Bd., Science & Engineering Indicators, 196 fig.7-2 (1993)). "Moreover, only 'about one in five American adults was able to provide an acceptable definition of a scientific study' and 'not more than a third of American adults have a minimal understanding of scientific process.'" *Id.* at 225–26 (citing Nat'l Sci. Bd., *supra*, at 210).

[57] Adler et al., *supra* note 35, at 17.

[58] Wagner, *supra* note 8, at 223, 224; Doremus, *supra* note 12, at 1037. "[P]olls also indicate that scientists are held in highest esteem relative to all other professional groups, with the possible exception of physicians." Wagner, *supra* note 8, at 224–25.

[59] "[I]n an era when seemingly miraculous technological developments are commonplace, lay policymakers may come to expect an endless stream of scientific answers." Wagner, *supra* note 8, at 195.

[60] *Id.* at 226.

[61] Doremus, *supra* note 12, at 1038.

[62] Wagner, *supra* note 8, at 227. Professor Doremus suggests that the current best available science mandate may be an attempt "to help society walk the razor's edge, avoiding extinction in as painless a manner as possible." *See* Holly Doremus, *The Purposes, Effects, and Future of the Endangered Species Act's Best Available Science Mandate*, 34 Envtl. L. 397, 419 (2004).

[63] Wagner, *supra* note 8, at 266–67.

[64] There is a subset of the American population that is highly suspicious of science. *See* Doremus, *supra* note 12, at 1039; Adelman, *supra* note 30, at 497 ("Americans have a love-hate relationship with science."). As of 1997, only twenty-five percent of Americans claimed to trust the federal government. Doremus, *supra* note 62, at 426–27 (citing Roderick M. Kramer, *Trust and Distrust in Organizations: Emerging Perspectives, Enduring Questions*, 50 Ann. Rev. Psychol. 569, 585 (1999)). Science no longer automatically offsets

sincere scientification of pressing policy issues is not the best way to solve our environmental problems.[65] This trend proves especially troubling in the conservation context, where public support for the program is crucial for species' long-term survival.

2. *The Importance of Education*

Alleviating Americans' suspicions about science requires providing them with access to and skill in interpreting scientific data.[66] Our conservation-based decision-making processes should be conducive to building bridges between scientists and non-scientists, helping the parties understand each others' perspectives.[67] Ideally, the public should develop a basic understanding of conservation biology, ecosystem management, population control, natural resource management theories, and regional planning.[68] Such an ecological education could make the public a more effective participant in the environmental debate.[69]

This educational effort should reach beyond the public at large to include our lawmakers on Capitol Hill. While Congress frequently extols the promise of science,[70] the way it has incorporated science into our envi-

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that distrust, in large part due to "highly publicized accounts of scientists serving as hired guns" for special interest groups. Doremus, *supra* note 62, at 427; Doremus, *supra* note 12, at 1040.

[65] Wagner, *supra* note 8, at 268.

[66] KINZIG ET AL., *supra* note 5, at 4. *See generally Policy-Oriented Curricula*, *supra* note 8, at 35 (describing issues that are important to decision-making in conservation biology).

[67] *See, e.g.*, ADLER ET AL., *supra* note 35, at 29–30 (suggesting that scientists use plain language and visual aids such as photographs, cartoons, and maps to help convey relevant information; scientists should also explain any assumptions behind their reasoning).

[68] *See generally Policy-Oriented Curricula*, *supra* note 8, at 35 (describing "particularly urgent" issues that must be taught in the conservation biology and sustainable community development contexts).

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> Effective environmentalism . . . must . . . overcome the idea that it is a special interest or simply a tradeoff for more important things. For environmentalism to become politically effective, however, requires an ecologically literate public—a constituency that understands that solving environmental problems is central to resolving virtually every other issue on the public agenda . . . . That level of awareness in turn requires an educational system that equips students to understand the basics of how nature works as a physical system and how human affairs are dependent on the health of that larger system. Often, however, this is not the case. By comparison, we would be much embarrassed were students to graduate from schools and colleges not knowing how to read or how to do basic math, but we are unconcerned if they graduate merely ignorant of how the world works ecologically and how that is related to their prospects in life.

David W. Orr, *Death and Resurrection: The Future of Environmentalism*, 19 CONSERVATION BIOLOGY 992, 994 (2005).

[70] Congress has demonstrated an "almost blind allegiance to the 'endless frontier' of science." Wagner, *supra* note 8, at 197.

ronmental laws indicates that, at least in the ecological context, it may not fully understand science's limitations:[71]

> Congress's record with regard to environmental lawmaking reveals a consistent pattern of misframing multidisciplinary environmental problems as predominantly or exclusively problems that can be resolved with science. A disturbing number of statutes and environmental programs charge agencies or advisory panels with developing science-based programs when the required scientific information may not be obtainable [or] presume needed baseline data will be collected without legislative incentives . . . .[72]

The scientific shortcomings of the Endangered Species Act (ESA)[73] and other environmental laws indicate that Congress either does not understand that its demands on science are unrealistic or that it feigns ignorance because scientific uncertainties are viewed as a political liability.[74]

However, as in the context of law generally, ignorance is no excuse and dishonesty is unacceptable. Environmental policy-makers should become versed in prevailing scientific theories, assumptions, norms, and methodologies.[75] It is true that a large number of expert advisors are available to answer Congress's science-based questions.[76] But if policymakers were to learn the basics of the pertinent science, they would be freed from their reliance on these scientific experts and better able to make informed science and policy judgments for themselves.[77] Further, such an educative effort would make it more difficult for those few "scientifically sophisticated legislators to exploit the ignorance of their colleagues."[78]

Finally, scientific education endeavors should extend to the courtroom.[79] Most lawyers and judges have little formal scientific training and

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[71] *Id.* at 245–46 ("[Legislators'] lack of formal scientific training may cause them to discount or ignore the limits of science unless the limits are made evident by using common sense or reading the newspaper.").

[72] *Id.* at 220.

[73] 16 U.S.C. §§ 1531–1544 (2005).

[74] Wagner, *supra* note 8, at 221.

[75] *Id.* at 194.

[76] *Id.* at 200. "Scientific staff, experts at hearings, and highly expert adjunct bodies like the former OTA [Office of Technology Assessment] or the National Academy of Sciences are utilized most often when Congress feels that their assistance will be helpful." *Id.* at 249 n.243.

[77] Congresspersons would be freed from relying "'on experts not only to provide them with answers to technical questions but also to inform them of the value assumptions imbedded in those answers and their implications for policy choices.'" *Id.* at 194–95 (quoting Susan E. Fallows, Technical Staffing for Congress: The Myth of Expertise 18 (1980) (unpublished Ph.D. Dissertation, Cornell University) (on file with Kroch Library, Cornell University)).

[78] *Id.* at 269.

[79] *See* Breyer, *supra* note 8:

learn much of their science from biased expert witnesses on either side of a judicial proceeding.[80] Ensuring that judges and lawyers understand the fundamentals of science—that they appreciate science's explanatory power while recognizing its limitations—would reduce opportunities for scientific opportunism and enhance the overall fairness of our judicial system.[81]

3. Scientists Versus Politics

While scientific education and understanding are essential for sensible environmental policy, some scientists may be wary of stepping up to the educational plate (especially in the Congressional or judicial context) for fear of becoming entangled in a political imbroglio.[82] Scientists have long maintained a distance between themselves and the political arena.[83] People trust in science primarily because scientists are thought to act as unbiased individuals.[84] Thus, a scientist is justifiably cautious when entering an ideological debate because in so doing he risks losing the aura of objectivity that surrounds his profession generally and his own research.[85]

> In this age of science, science should expect to find a warm welcome, perhaps a permanent home, in our courtrooms. The legal disputes before us increasingly involve the principles and tools of science. . . . Our decisions should reflect a proper scientific and technical understanding so that the law can respond to the needs of the public.

Justice Breyer references the Federal Judicial Center-National Academy of Sciences collaboration through the Program in Science, Technology, and Law; this program brings together scientists, engineers, attorneys, judges, and government officials in an effort to promote communication and enhance understanding. *Id.* Associate Professor Wagner also advocates court reform as "a necessary supplement to congressional reeducation initiatives." Wagner, *supra* note 8, at 274–76.

[80] Adler, *supra* note 46, at 352. *See also* Breyer, *supra* note 8 ("[M]ost judges lack the scientific training that might facilitate the evaluation of scientific claims or the evaluation of expert witnesses who make such claims."). For an illustration of justices' different understandings of ecological and biological principles, compare Justices O'Connor's and Scalia's opinions in Babbitt v. Sweet Home Chapter of Cmtys for a Great Or., 515 U.S. 687 (1995). *See also* Adler, *supra* note 46, at 334–41 (2003) (discussing the importance of lawyers and judges understanding how science is conducted).

[81] Adler, *supra* note 46, at 348, 354. Justice Stephen Breyer has recognized that while courts should seek decisions based on scientifically sound knowledge, "[t]he search is not a search for scientific precision. We cannot hope to investigate all the subtleties that characterize good scientific work. A judge is not a scientist, and a courtroom is not a scientific laboratory." Breyer, *supra* note 8.

[82] *See* Wagner, *supra* note 8, at 239 (suggesting that scientific experts may be wary that "educating policymakers about the limits of science . . . may be seen as conflicting with the scientist's primary commitment to objectivity, because such activities require both access to and active participation in the political process.").

[83] *See, e.g.*, *Policy-Oriented Curricula*, *supra* note 8, at 33 ("[S]tudents are encouraged to avoid politics, policy, or value discussions because these 'corrupt' objective science and professionalism.").

[84] Primm & Clark, *supra* note 9, at 1040–41.

[85] Robert Pool, *Struggling to Do Science for Society*, 248 SCIENCE 672, 672 (1990).

However, scientists' expertise with regard to environmental issues brings with it a responsibility to participate in important conservation-related decisions.[86] With regard to species conservation, there may be only one "expert" on a particular species. In that case, the scientist-expert may be the only one who can effectively inform the policy-making process. It is entirely appropriate in such a situation for a scientist to step into the policy arena, as long as he carefully balances scientific objectivity with effective action.[87] By entering the policy arena in this manner, a scientist stands poised to inform the conservation process, facilitate effective conservation measures, and unify disparate stakeholders.

E. Biases in Science

Science's contribution to achieving conservation-related goals—indeed its major role in environmental disputes generally—stems from the fact that it is "often the only potential unifying standard among the disparate interest stakeholders who mutually distrust each other."[88] Science's unifying ability derives from its apparent objectivity, and, to the extent possible, environmental and natural resource scientists strive to remain unbiased in their research endeavors.[89]

But, while society proceeds according to the assumption that science is innately objective, assumptions and biases inhere in all scientific endeavors.[90] These sometimes subtle biases result not from the nature of science or from scientific processes *per se*; rather, they result from the fact that *scientists* are human beings. As human beings, scientists have world views shaped by personal perspectives, prior experiences, and culture.[91] Because scientists bring a human element to them, bias becomes inextricably woven into scientific endeavors. In order to see how this affects conservation science and law, it is critical to see just how and where this bias manifests itself.

At the most fundamental level, scientists' specialized training leads to a bias in valuing the scientific method and applied scientific processes, such as observation, over other methods of gleaning knowledge about the world.[92]

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[86] *Policy-Oriented Curricula*, *supra* note 8, at 37.

[87] *See* Pool, *supra* note 85, at 672 (discussing the tension between being cautious with this data and being an effective advocate). This balancing act has been said to place scientists in a "double ethical bind." *Id.*

[88] Tarlock, *supra* note 14, at 136.

[89] *See* Clark, *supra* note 3, at 23 (noting that scientists try to remain "as free as possible from parochial interests, cultural biases, ideologies, disciplinary rigidities, and fixed bureaucratic loyalties.").

[90] ADLER ET AL., *supra* note 35, at 16.

[91] *Id.* at 15–16.

[92] Barry Ross Muchnick, *(W)helping the Wolves: a Perspective on De-listing Endangered Species in Minnesota*, *in* YALE SCH. OF FORESTRY & ENVTL. STUDIES, BULLETIN SERIES NO. 105, SPECIES AND ECOSYSTEM CONSERVATION: AN INTERDISCIPLINARY APPROACH 105, 109 (Tim W. Clark et al. eds., 2001); Primm & Clark, *supra* note 9, at 1041.

Scientific training endows scientists with skills in certain kinds of problem solving; thus, scientists tend to "convert or redefine problems into those" that science may solve.[93] Imbuing scientists with this kind of bias begins in the early phases of scientific training. The curricula through which many natural resource scientists receive their training often emphasize scientific positivism, quantification methods, and predictive methods.[94]

Biases and value judgments also affect what problems scientists decide are worth researching in the first place.[95] In fact, numerous professional scientific activities reflect some value judgment, including writing and publication, teaching, and serving on government advisory committees.[96] Each choice and each research activity that a scientist undertakes provides him with an opportunity to influence policy. There is, in fact, a kind of reciprocal relationship between a conservation scientist's research and public policy: just as a scientist can influence policy, his ability to do particular research in the first instance may be inextricably bound up in the outcome of a public policy decision.[97]

Thus "success in science depends not upon complete absence of prejudice, but upon the presence of beneficial prejudices." *Id.* (quoting A. J. Bahm, *Science Is Not Value-Free*, 2 Policy Sci. 391, 394 (1971)).

[93] Primm & Clark, *supra* note 9, at 1041.

[94] *Policy-Oriented Curricula*, *supra* note 8, at 33. The recent push for interdisciplinary education in natural resource programs has come from without and within university systems. For example, the School of Renewable Natural Resources at The University of Arizona is offering a graduate seminar on the biology and management of endangered species. Taught by Wildlife and Fisheries Professor Cecil Schwalbe, this course discusses, *inter alia*, whether the ESA is working, and if not, what changes should be made. Cecil Schwalbe, *"The Night Time is the Right Time . . ." for the Biology and Management of Endangered Species*, 4 Renew (Sch. of Nat. Resources, C. of Agric. and Life Sci., U. of Ariz., Tucson, Ariz.), Fall 2004, at 11. *See also* Kinzig et al., *supra* note 5, at 5 (advocating that the National Sciences Foundation "[p]romote research to identify effective approaches in interdisciplinary education; [i]ncrease resources for development of interdisciplinary environmental courses or programs; [and i]ncrease funding for innovative graduate and post-graduate interdisciplinary fellowships").

[95] Primm & Clark, *supra* note 9, at 1041.

[96] *Policy-Oriented Curricula*, *supra* note 8, at 33–34. Value judgments inhere in

> [C]onducting research (basic and applied); writing and publishing technical articles, monographs, and books on species, ecosystems, and conservation subjects; lecturing to professional audiences and making public presentations on matters of professional and civic interest; teaching short courses, in-service training programs, and formal university courses; participating in professional organizations and societies; preparing, reading, commenting on, and reinterpreting agency (and others') decisions and documents (*e.g.*, environmental impact statements); advising organizations, such as nongovernmental conservation groups, or serving on boards and formal advisory bodies; consulting or negotiating with allies and adversaries; bringing out (or concealing) facts or policies that decisionmakers need; and serving as ordinary or expert witnesses.

Id.

[97] I.e., where the scientist's professional research involves studying the species in question, or where a scientist acting as an expert was previously involved with the relevant research. Adler et al., *supra* note 35, at 16; Brennan et al., *supra* note 6, at 428.

Since scientists' choices (perhaps subconsciously) reflect values, and since those choices ultimately shape people's beliefs about public policy, the relationship between science and the policy realm is complex.[98] On the one hand, science is seen as a prerequisite to public policy; on the other, it is a discipline that must remain separate from that policy.[99] This disjunction reflects the notion that once a scientific issue becomes a public policy issue—as it so often does in the conservation context—"it is no longer science as usual."[100] What scientists and the public must come to realize, however, is that merely by engaging in the business of "science as usual" scientists will influence policy. As long as the value judgments informing the scientific research agenda respond to societal needs and do not impact scientists' scientific interpretations and conclusions, scientists can play an instrumental role in informing the conservation policy debate.[101]

And, in general, scientists are quite able to be professional and honest despite any personal biases they may have.[102] Scientists remain scientists, and their reputations depend on their ability to objectively and honestly analyze data and present their research findings.[103] This is true even in the conservation biology context, which "is not concerned with knowledge for its own sake but rather is directed towards particular goals," most notably maintaining biodiversity.[104] Scientists know that credible science is key to achieving conservation-related goals, and that misleading the public about the state of the science only confounds those goals in the long run.[105]

III. Science in Environmental Law

A. The History of Science in Conservation

Given that science and value judgments both play into our country's environmental policy-making scheme, it is worthwhile to see how science *qua* science came to dominate our environmental law framework.

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[98] Primm & Clark, *supra* note 9, at 1041.

[99] *Policy-Oriented Curricula*, *supra* note 8, at 33.

[100] Pool, *supra* note 85, at 672.

[101] Doremus, *supra* note 12, at 1066.

[102] *Id.* at 1150.

[103] *Id. See also* Research and Management Techniques for Wildlife and Habitats 6 (Theodore A. Bookhout ed., 1994).

[104] Doremus, *supra* note 12 at 1149–50. The scientific journal Conservation Biology ran an editorial by academic scientists and environmental activists defending the ESA, writing that "[t]he vast majority of biological scientists agrees fundamentally about the importance of conserving the diversity of life on Earth." *Id. See also* P. Dee Boersma et al., *How Good Are Endangered Species Recovery Plans?*, 51 Bioscience 643, 648 (2001) (commenting that conservation biology can identify ways to protect imperiled species at the lowest cost to humans).

[105] *See* Doremus, *supra* note 12, at 1150–51.

The United States conservation movement grew out of a scientific tradition and the faith that science and reason could benefit society.[106] From its early Gifford Pinchot days, the U.S. Forest Service emphasized scientific training and expert decision-making, and early environmentalists like Rachel Carson relied on science to explain the dangers of environmental pollutants.[107] The apparent ability of science to solve our environmental woes was reflected in many of the environmental statutes enacted in the 1960s and 1970s, which required that conservation decisions be science-based.[108] For example, the Marine Mammal Protection Act[109] mandates reliance on the best available science, as does the Safe Drinking Water Act.[110] The Endangered Species Act[111] represents an extreme example of the conservation movement's faith in science: under the Act's listing provisions, consideration of factors other than the best available science is expressly forbidden.[112]

B. The Endangered Species Act

The Endangered Species Act of 1973 (ESA)[113] represents a commitment by Americans to "halt and reverse the trend toward species extinction, whatever the cost."[114] Halting and reversing the trend toward species extinction necessarily requires an application of our best scientific understanding of species and ecosystem dynamics, and the text of the Act reflects this scientific reality.

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[106] *See, e.g.*, RACHEL CARSON, SILENT SPRING (1962). Doremus, *supra* note 12, at 1040; Tarlock, *supra* note 14, at 137. This scientific tradition is also visible in the international arena. For example, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) invokes science as the basis for resource management decisions. CITES, preamble, Mar. 3, 1973, 27 U.S.T. 1087, 993 U.N.T.S. 244, *available at* http://www.cites.org.

[107] Doremus, *supra* note 12, at 1040; Adelman, *supra* note 30, at 518 n.84. This technocratic tradition ran strong until the 1970s, when legislation such as the National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321–4347 (2005), and the National Forest Management Act (NFMA), 16 U.S.C. §§ 1600–1614 (2005), expanded the public's role in environmental decision-making. Doremus, *supra* note 12, at 1041. *See also* Tarlock, *supra* note 14, at 137.

[108] Doremus, *supra* note 12, at 1041.

[109] 16 U.S.C. §§ 1361–1421h (2005). *See, e.g.*, § 1371 (requiring "best scientific evidence available").

[110] 42 U.S.C. §§ 300f–300i-26 (2005) ("[B]est available, peer-reviewed science and supporting studies conducted in accordance with sound and objective scientific practices."). *See also* The Fishery Conservation and Management Act of 1976 (the Magnuson Act), 16 U.S.C. §§ 1801–1883 (2005), which contains a best science mandate (*see, e.g.*, § 1801 ("best scientific information available")).

[111] 16 U.S.C. §§ 1531–1544 (2005).

[112] 16 U.S.C. § 1533(b)(1)(A) ("The Secretary shall make determinations required by subsection (a)(1) of this section solely on the basis of the best scientific and commercial data available.").

[113] 16 U.S.C. §§ 1531–1544.

[114] Tenn. Valley Auth. v. Hill, 437 U.S. 153, 184 (1978).

Numerous provisions of the Act explicitly require consideration of science when making ESA-related determinations.[115] The ESA contains several scientific standards, including the "best available biological information derived from professionally accepted wildlife management practices" standard;[116] the "substantial scientific or commercial information" standard;[117] and the "best scientific and commercial data available" standard.[118]

1. Why Rely on Science?

The ESA's commitment to scientific principle stems in part from the discipline's unifying ability as well as from the prominent role science has played in the American conservation movement in general. Reliance on science also reflects an understanding that good science is vital to species conservation.[119] Science alone can provide agencies with key population, trend, and life history data; science is central to interpreting just what this information means for a particular species. Expert scientific judgment is also important because incomplete data and imperfect model outputs require informed interpretation.[120] Thus, science clearly plays an important role in protecting imperiled species. Exactly why Congress incorporated science into the ESA in precisely the way it did, however, is less clear.

2. Why the "Best Scientific and Commercial Data Available" Standard?

a. Origins of the Best Available Science Standard

The origins of the ESA's "best scientific and commercial data available" (i.e., best available science) mandate cannot be gleaned from the statute's legislative history.[121] It appears to have been carried over from earlier federal endangered species legislation.[122] The Endangered Species Preservation Act of 1966, for example, required the Secretary of the Interior to consult

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115 Collectively these requirements can be thought of as ESA's "best available science mandate." Doremus, *supra* note 62, at 405.

116 16 U.S.C. § 1537a(c)(2). This standard applies to decisions and advice under ESA which implement the Convention on International Trade in Endangered Species (CITES). *Id.*

117 16 U.S.C. § 1533(b)(3)(A). The "substantial science" standard is triggered when citizens petition for the listing or delisting of a species. *Id.* Formal review of the species' listing status will not be triggered unless the citizen presents "substantial scientific information" supporting his requested action. § 1533(b)(3)(D).

118 *See, e.g.*, 16 U.S.C. § 1533(b)(1)(A) (listing determinations based on the "best scientific and commercial data available").

119 Doremus, *supra* note 12, at 1118.

120 *Id.* at 1118–21. *See also* Ruckelshaus et al., *supra* note 12, at 696 (listing four categories of data: measured data, extrapolated data, modeled data, and expert opinion).

121 Doremus, *supra* note 62, at 418.

122 *Id.*

with scientists and scientific organizations when making listing determinations.[123] The Endangered Species Conservation Act of 1969[124] did away with the explicit consultation requirement but introduced the "best scientific and commercial data available" standard.[125] This standard was carried over, without comment, into the 1973 ESA.[126]

While the Congressional motives for incorporating the best available science mandate remain unclear, Professor Holly Doremus of the University of California, Davis Law School surmises that the standard "was generally intended to ensure objective, value-neutral decision making by specially trained experts."[127] Relying on science rather than politics might also have been a way to enhance the ESA's legitimacy and foster public support for the legislation.[128] By the same token, reliance on science would have given politicians the opportunity to shield themselves from unpopular decisions made under the Act.[129] Finally, requiring that ESA decisions be grounded in science would also have been a way for Congress to protect agency decisions from exacting judicial review.[130]

Regardless of their motivations or intentions, Congress embraced the "best scientific and commercial data available" standard. The Endangered Species Act overwhelmingly calls for agencies to use the best available science when making ESA determinations. Reliance on this scientific standard reaches its logical extreme in Section 4's "strictly science" mandate, which prohibits, in the context of listing determinations, the consideration of any factor but the "best scientific and commercial data available."[131]

b. The Best Available Science Standard in Action

i. Section 4: Listing

Section 4 of the ESA authorizes the U.S. Fish and Wildlife Service (FWS)[132] and NOAA Fisheries[133] (collectively "wildlife agencies") to identify and list "threatened" and "endangered" species.[134] Endangered species

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[123] Pub. L. No. 89-669 § 1(c), 80 Stat. 926 (1966) (repealed 1973) ("[T]he Secretary shall . . . seek the advice and recommendations of . . . ornithologists, ichthyologists, ecologists, herpetologists, and mammalogists.").

[124] Pub. L. No. 91-135, 83 Stat. 275 (1969) (repealed 1973).

[125] *Id*. § 3(a).

[126] *See* Doremus, *supra* note 62, at 418.

[127] *See id.* at 419.

[128] *Id.* at 418.

[129] *Id.*

[130] *Id.*

[131] 16 U.S.C. § 1533(b)(1)(A) (2005). *See* Doremus, *supra* note 12, at 1051.

[132] The Department of the Interior's FWS oversees protection of terrestrial species and freshwater fishes. *See* Doremus, *supra* note 62, at 401.

[133] The Department of Commerce's NOAA Fisheries (i.e., the National Marine Fisheries Service) oversees anadromous fish and marine species. *See id.*

[134] 16 U.S.C. § 1533(a)(1). The listing process can be initiated by either the agencies themselves, or by citizen petition. 16 U.S.C. §§ 1533(b)(1)(A), (b)(3)(A). Section 4 also au-

are those in danger of extinction throughout all or a significant portion of their range;[135] threatened species are those that, while not yet endangered, are likely to become so in the foreseeable future.[136]

The ESA requires that listing decisions be made solely on the basis of the "best scientific and commercial data available."[137] This "strictly science" mandate emerged from the 1982 Amendments to the Act,[138] and was meant to prevent non-biological considerations—specifically economic considerations—from impacting listing decisions.[139] According to Congress, economic considerations are irrelevant to determining whether a species is endangered or threatened.[140]

When making a listing determination, the "strictly science" mandate requires a wildlife agency to consider: "(A) the present or threatened destruction, modification, or curtailment of [the species'] habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; [and] (E) other natural or manmade factors affecting [the species'] continued existence."[141]

ii. Section 7: Jeopardy

Section 7 of the ESA provides that any action carried out, funded, or authorized by any federal agency ("agency action") may not "jeopardize" the continued existence of a listed species or adversely modify its critical habitat.[142] An action "jeopardizes" a species if it is expected to appreciably reduce the likelihood of a species' survival and recovery or if it appreciably diminishes the value of the species' critical habitat.[143] Jeopardy determi-

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thorizes the agencies to designate critical habitat and develop a recovery plan for each listed species. 16 U.S.C. §§ 1533(a)(3), (f). Economic considerations are permitted with regard to critical habitat designations. 16 U.S.C. § 1533(b)(2).

[135] 16 U.S.C. § 1532(6) (2005). Excepted are species of the Class Insecta whose protection would "present an overwhelming and overriding risk to man." *Id.*

[136] 16 U.S.C. § 1532(20).

[137] 16 U.S.C. § 1533(b)(1)(A).

[138] Doremus, *supra* note 12, at 1055.

[139] *Id.*

[140] *Id.*

[141] 16 U.S.C. § 1533(a)(1)(A)–(E).

[142] 16 U.S.C. § 1536(a)(2) (2005). Section 7 has been construed broadly by the courts. Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 309 (2003). Jeopardy determinations require agencies to make technically difficult assessments; agencies must use their best professional judgment to best incorporate the available evidence and site-specific characteristics. *See* NATIONAL RESEARCH COUNCIL, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: CAUSES OF DECLINE AND STRATEGIES FOR RECOVERY 325 (2004), *available at* http://www.nap.edu [hereinafter NRC FINAL REPORT]. Exemptions to this no jeopardy provision can be issued by the Endangered Species Committee, aptly nicknamed the "God Squad." 16 U.S.C. § 1536(e)–(p).

[143] *See* 50 C.F.R. § 402.02 (2004). Critical habitat includes those "areas within the geographical area occupied by the species, at the time it is listed . . . on which are found those

nations are to be made on the basis of the "best scientific and commercial data available."[144]

Section 7 requires that any federal agency, before commencing with any agency action, consult with the Secretary to determine if any listed species may be present in the area of the proposed action.[145] If the Secretary advises that a listed species may be present, the agency must conduct a biological assessment (BA) to identify the extent to which the proposed action is likely to affect the listed species.[146] If the agency finds that an adverse effect is likely, the action agency must undergo a formal consultation with the appropriate wildlife agency.[147] The end product of the formal consultation is the wildlife agency's formulation of a non-binding biological opinion (BO), which indicates whether or not the agency action is likely to jeopardize the species' continued existence or adversely modify its critical habitat.[148]

If the wildlife agency finds that the species is unlikely to be jeopardized by the proposed agency action, it will issue a "no jeopardy opinion."[149] Conversely, if the wildlife agency finds that jeopardy to the species is likely to result from the proposed agency action, the wildlife agency will

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physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection." 16 U.S.C. 1532(5)(A)(i) (2005). Unoccupied areas can also be included if they are deemed essential to the species' conservation. 16 U.S.C. § 1532(5)(A)(ii). An agency's critical habitat designation rests on its consideration of "primary constituent elements," including "roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species or plant pollinator, geological formation, vegetation type, tide, and specific soil types." 50 C.F.R. § 424.12(b)(5) (2004). Critical habitat designations must be made "on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat." 16 U.S.C. § 1533(b)(2). If the benefits of excluding an area as critical habitat outweigh the benefits of the designation, the agency may exclude that area *unless* species extinction would result from the failure to designate. *Id. See also* New Mexico Cattle Growers Ass'n v. United States Fish & Wildlife Serv., 248 F.3d 1277 (10th Cir. 2001) (agency must quantify both baseline and incremental effects when assessing economic impacts).

[144] 16 U.S.C. § 1536(a)(2).

[145] *Id.* The Secretary's determination of whether a species is likely to be present is to be based on the best scientific and commercial data available. 16 U.S.C. § 1533(c)(1).

[146] 16 U.S.C. § 1536(c)(1).

[147] 50 C.F.R. § 402.14(a).

[148] 50 C.F.R. § 402.14(e). The BO is not legally binding on the action agency; but if an agency ignores the BO it remains accountable for any ESA violation. *See* Sierra Club v. Froehlke, 534 F.2d 1289, 1303–04 (8th Cir. 1976):

> Consultation under Section 7 does not require acquiescence. Should a difference of opinion arise as to a given project, the responsibility for decision after consultation is not vested in the Secretary but in the agency involved. . . . [The action agency] is to take "such action necessary to insure that actions authorized, funded, or carried out do not jeopardize the continued existence of such endangered species."

See also 50 C.F.R. § 402.15.

[149] 50 C.F.R. § 402.14(h)(3).

c. Interpreting the Scientific Mandate

While the ESA repeatedly calls for wildlife agencies to use the best scientific data available in various contexts, nowhere does Congress explain what it means by "best," "available," or even what it means by "science."[162] Thus, it is important to explore what could possibly be meant by this mandate.

i. Defining "Science"

In *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, the Supreme Court defined "scientific knowledge" as that knowledge "derived by the scientific method."[163] This rough definition is seemingly more directly applicable to those basic sciences which lend themselves to strict application of the scientific method in a laboratory setting. Environmental concerns, on the other hand, often "evade definitive scientific answers."[164] As discussed in Part II, *supra*, natural resource-based, applied sciences can provide useful information pertaining to species conservation, but they cannot provide us with the one "right" answer to a particular conservation problem.

The inability of science to provide us with one "right answer" has been recognized by scientists, the courts, and the legislature. Thus, "[s]imply by mandating reliance on science [in the ESA], Congress implicitly sanctioned some uncertainty."[165] It is inevitable, given the nature of science and the nature of species conservation, that agencies must often act with an incomplete understanding.[166] Such action is entirely appropriate in the conservation context because wildlife agency scientists are equipped with the requisite expertise to reasonably interpret incomplete data.[167] In addition, political pressures and legal constraints prevent wildlife agencies from listing species on a whim.[168]

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[162] Doremus, *supra* note 12, at 1056; Brennan et al., *supra* note 6, at 390 (noting that despite the ESA's "near-talismanic" reliance on the best science available standard, Congress "failed to provide guidance on how to determine whether particular data meets this standard").

[163] 509 U.S. 579, 590 (1993).

[164] Wagner, *supra* note 8, at 188–89.

[165] Doremus, *supra* note 12, at 1075.

[166] *Id.*

[167] *Id*. Compare the courts' reluctance to let uncertain scientific data in front of scientifically illiterate juries. *Id.*

[168] Specifically, judicial review under the Administrative Procedure Act (APA) acts as a legal constraint on agency behavior. 5 U.S.C. § 706(2)(A) (2005). Further, under the ESA itself, scientists must acknowledge uncertainties and data gaps, heed all relevant factors including countervailing information, and finally justify their conclusions. Doremus, *supra* note 12, at 1076–77. Professor Doremus argues in another article that the APA, in effect, subsumes the role of the best available science mandate in ESA decisions. Doremus, *supra* note 62, at 421–24. Professor Doremus further argues that President Clinton's 1993 Executive Order 12,866, which requires agencies to "base [their] decisions on the best reasonably obtainable scientific, technical, economic, or other information concerning the need for, and consequences of, the intended regulation" also makes the best science available mandate

Not only is acting in the face of scientific uncertainty appropriate in the conservation context, it is in fact *required* by the ESA. Wildlife agencies are not permitted to postpone listing determinations pending further scientific research and *must* make discretionary decisions when complete data are unavailable.[169] In order to make the most informed science-based decision possible, a wildlife agency may consider information gleaned from multiple sources including primary sources (e.g., peer-reviewed journals), expert opinions,[170] dissertations, other government agency reports (e.g., Forest Service or Bureau of Land Management), and "gray literature."[171]

ii. Defining the "Best Available Science"

(a) Congress and the Courts

The "best scientific and commercial data available" standard, while appearing throughout the ESA, remains undefined in the statutory text and is little discussed in the legislative history.[172] The courts, on the other hand, have provided some guidance.

The Supreme Court has stated that the standard's "obvious purpose . . . is to ensure that the ESA not be implemented haphazardly, on the basis of speculation or surmise."[173] Other courts have been more specific as to exactly what the standard requires. Most importantly, the courts have held that this standard requires the wildlife agencies to use the best scientific data *available*, not the best scientific data *possible*.[174] The agencies may not wait for conclusive data before making a decision and thus "must rely on even inconclusive or uncertain information if that is the best avail-

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seem redundant. *Id.* at 424 (citing Exec. Order No. 12,866 § 10, 58 Fed. Reg. 51,744 (1993)).

169 *See* City of Las Vegas v. Lujan, 891 F.2d 927, 933 (D.C. Cir. 1989) ("Even if the available scientific and commercial data were quite inconclusive, [the Secretary] may—indeed *must*—still rely on it.") (emphasis added); Sw. Ctr. for Biological Diversity v. Norton, No. 98-934, 2002 WL 1733618, at *9 (D.D.C. July 29, 2002) ("Another implication of the 'best scientific data available' requirement is that FWS must rely on even inconclusive or uncertain information if that is the best available at the time of the listing decision."). *See also* Doremus, *supra* note 12, at 1078.

170 Seeking external expert advice can improve the quality of an agency's risk assessment, provide that assessment with a "scientific seal of approval," and help deflect criticism of that assessment. Noah, *supra* note 21, at 1051.

171 Gray literature is "other unpublished material." *See* Endangered and Threatened Wildlife and Plants: Notice of Interagency Cooperative Policy on Information Standards Under the Endangered Species Act, 59 Fed. Reg. 34,271, 34,271 (July 1, 1994) [hereinafter Information Standards Policy]. *See also* Doremus, *supra* note 12, at 1079–81. The ESA also requires consideration of public input. It is unlikely that this input will receive much weight, however, unless it comes from the scientific community. *Id.* at 1081–82.

172 Brennan et al., *supra* note 6, at 404.

173 Bennett v. Spear, 520 U.S. 154, 176 (1997).

174 *See Sw. Ctr. for Biological Diversity*, 2002 WL 1733618, at *8 (citing Bldg. Indus. Ass'n of Superior Cal. v. Norton, 247 F.3d 1241, 1246 (D.C. Cir. 2001)).

able at [decision] time."[175] Further, the wildlife agencies need not conduct independent research to augment the existing data pool,[176] and relatively minor flaws in scientific data do not render that data unreliable.[177] As long as a wildlife agency adheres to the above guidelines, is transparent in its data consideration and decision-making process,[178] does not disregard "scientifically superior" data,[179] and does not "unreasonably rely[ ] on certain sources to the exclusion of others,"[180] it is complying with the courts' interpretation of the best available science mandate.

(b) Interagency Cooperative Policy

The wildlife agencies, too, have attempted to substantiate the ESA's amorphous "best scientific and commercial data available" standard. In 1994, the FWS and NOAA Fisheries issued a joint policy statement outlining their approach to this standard.[181] The stated goal of the joint policy is to "provide criteria, establish procedures, and provide guidance to ensure that decisions made by the Services under the authority of the Endangered Species Act of 1973 (Act), as amended represent the best scientific and commercial data available."[182]

Per the joint policy, the wildlife agencies are to gather, review, and evaluate information on species abundance, status, distribution, trends, biol-

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[175] *Id.* at *8, *9; *see also* Defenders of Wildlife v. Babbitt, 958 F. Supp. 670, 680 (D.D.C. 1997) ("[T]he [ESA's] 'best available data' standard . . . require[s] far less than 'conclusive evidence.'").

[176] *Sw. Ctr. for Biological Diversity*, 2002 WL 1733618, at *9.

[177] *See id.* at *8 (citing *Bldg. Indus. Ass'n of Superior Cal.*, 247 F.3d at 1246–47); Greenpeace Action v. Franklin, 14 F.3d 1324, 1336 (9th Cir. 1993) ("When an agency relies on the analysis and opinion of experts and employs the best evidence available, the fact that the evidence is 'weak,' and thus not dispositive, does not render the agency's determination 'arbitrary and capricious.'"); Blue Water Fisherman's Ass'n v. Nat'l Marine Fisheries Serv., 226 F. Supp. 2d 330, 338 (D. Mass. 2002) ("[I]mperfections in the available data do not doom any agency conclusion . . . . The agency's conclusion need not be airtight and indisputable.").

[178] Ruhl, *supra* note 6, at 581.

[179] *Sw. Ctr. for Biological Diversity*, 2002 WL 1733618, at *8 (quoting City of Las Vegas v. Lujan, 891 F.2d 927, 933 (D.C. Cir. 1989), and citing S.W. Ctr. for Biological Diversity v. Babbitt, 926 F. Supp. 920, 927 (D. Ariz. 1996)).

> [T]his provision merely prohibits the Secretary from disregarding available scientific evidence that is in some way better than the evidence he relies on. . . . Since there is no allegation that the Secretary disregarded scientifically superior evidence that was available to him at the time[,] . . . he satisfied his duties under [the ESA].

Lujan, 891 F.2d at 933.

[180] *Sw. Ctr. for Biological Diversity*, 2002 WL 1733618, at *8.

[181] Information Standards Policy, *supra* note 171. The FWS regulations also list "the opinions or views of scientists or other persons or organizations having expertise concerning the wildlife" as an important consideration in the permit-issuing context. 50 C.F.R. §§ 17.22(a)(2)(v), 17.32(a)(2)(v) (2004).

[182] Information Standards Policy, *supra* note 171.

ogy, and ecology before making an ESA-related decision.[183] This information can come from a wide variety of sources, including other federal agencies, state natural resource agencies, tribal governments, consulting firms, universities, contractors, and professional organizations.[184] The information gathered can be gleaned from written documents (e.g., professional journals, status surveys, biological assessments, and "gray literature"),[185] oral communications, or anecdote.[186] The wildlife agencies are to actively gather and impartially evaluate information that runs counter to the agencies' official positions or actions.[187] Since the information gathered by the wildlife agency from these many diverse sources may vary in quality,[188] biologists are to review the information and rely only on the most reliable and credible data available (primary sources are preferred).[189] Finally, once an ESA-related document has been drafted by agency biologists, it undergoes an agency management-level review "to verify and assure the quality of the science."[190]

(c) Interagency Peer Review Policy

The wildlife agencies also published a joint peer review policy to further ensure that ESA decisions are made on the basis of the best available science.[191] In this policy, the agencies state that:

> [i]ndependent peer review will be solicited on listing recommendations and draft recovery plans to ensure the best biological and commercial information is being used in the decision-making process, as well as to ensure that reviews by recognized experts are incorporated into the review process of rulemakings and recovery plans developed in accordance with the requirements of the Act.[192]

The policy recommends that "three appropriate and independent specialists" evaluate the taxonomic, population, and other pertinent biological

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[183] *Id.*
[184] *Id.*
[185] *Id.*
[186] *Id.*
[187] *Id.*
[188] *Id.*
[189] *Id.* Note that while the policy provides procedural guidance for the agencies, it does not provide a working definition of "best available scientific data." Brennan et al., *supra* note 6, at 406.
[190] Information Standards Policy, *supra* note 171. All sources used by the agency "shall be retained as part of the administrative record supporting an action" and shall be referenced in all related Federal Register notices and biological opinions. *Id.*
[191] Endangered and Threatened Wildlife and Plants: Notice of Interagency Cooperative Policy for Peer Review in the Endangered Species Act Activities, 59 Fed. Reg. 34,270, 34,270 (July 1, 1994).
[192] *Id.*

and ecological data used in listing determinations.[193] With respect to recovery plans, the wildlife agencies are to use independent peer review to ensure that the best available scientific and commercial information is obtained and used in decision-making.[194] The policy also provides for "special independent peer review" when an "unacceptable level of scientific uncertainty" demands an extension of the statutory rule-making period.[195] Peer reviewers' opinions are to be summarized and included in the final decision document, and all reports, opinions, and data used in the peer reviews are to be included in the administrative record of the final decision.[196]

(d) Role of the Wildlife Agencies

(i) Congress's Choice

As demonstrated by the above discussion, the wildlife agencies implementing the ESA must interpret vague mandates and respond to broadly defined species conservation problems.[197] The wildlife agencies are also faced with inadequate funding, poor enforcement abilities, and personal politics.[198] So why would Congress choose to vest two understaffed, underfunded agencies with the responsibility for implementing the ESA in the first place?[199]

Congress's approach is in fact quite practical and more sensible than any alternative. First, it makes sense for Congress to assign the specifics of recovery planning to the wildlife agencies because these agencies have more expertise than the legislative branch and more time to devote to species conservation issues.[200] As discussed in Part III.B, *supra*, scientific

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[193] *Id.* Independent peer reviewers are to be chosen from the academic and scientific community, tribal groups, state agencies, other federal agencies, and the private sector. *Id.*

[194] *Id.*

[195] *Id.*

[196] *Id.*

[197] Primm & Clark, *supra* note 9, at 1040.

[198] *Id.*

[199] The origins of the use of expert agencies can be found in the New Deal model of administrative expertise. This model rests on the assumption that effective decision-making will result from rational discourse "between elite civil servants and the scientific community." Tarlock, *supra* note 14, at 148. In an ideal world, these expert government agencies transcend interest group dynamics and serve as neutral administrators carrying out the People's will. Primm & Clark, *supra* note 9, at 1040. Critics of this model maintain that it cannot avoid value-choices and only serves to undermine democracy. *See* Tarlock, *supra* note 14, at 148 ("Environmentalism . . . exposed the myth that expert administration could avoid the value conflicts inherent in all resource choices."). *See also* Primm & Clark, *supra* note 9, at 1040 ("[An] amalgam of professional, organizational, parochial, and personal influences inevitably leads bureaucrats to favor certain policies actively and to seek to influence the policy process through problem definition, program design, and implementation.").

[200] Primm & Clark, *supra* note 9, at 1040. The agencies have the expertise to "face three major scientific challenges: identifying the units of conservation, establishing recovery goals, and recommending management actions that . . . ultimately meet those recovery goals." Ruckelshaus et al., *supra* note 12, at 670.

expertise in the species conservation arena is required from both a practical and a legal standpoint. Further, agencies may be superior to Congress in terms of fact-finding and consensus-building around environmental issues.[201] Finally, agencies are more flexible than Congress. Since regulations are subject to reexamination and refinement as scientific knowledge advances, agencies can "adapt rules to new information, policy back-talk . . . , and changes in science."[202] However, while wildlife agencies are sensible overseers of the endangered species protection process, the burden the agencies shoulder is far from perfect, and far from fair. Congress has, in many respects, charged the wildlife agencies with the impossible.

(ii) Setting the Wildlife Agencies Up for Failure

The most unfortunate victims of the shortcomings of the current ESA are the endangered and threatened species the Act is meant to—but fails to—protect. However, the agencies charged with implementing the ESA are also victims of the statute's limitations. By requiring that ESA listing decisions be based solely on science, Congress has charged the wildlife agencies with an impossible task.[203]

Specifically, "the ESA's 'strictly science' mandate rests on the assumption that conservation policy decisions can be made objectively on the basis of existing or reasonably attainable scientific knowledge. Because that assumption is wrong [because listing decisions inevitably involve incomplete data and value choices] the mandate has been impossible to implement."[204] Congress has, in essence, forced the wildlife agencies to make multidisciplinary decisions in the name of science. This "science charade"[205] results in an incoherent, inconsistent listing program and threatens to undermine support for science generally and the ESA specifically.[206]

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[201] Wagner, *supra* note 8, at 279 (citing JERRY L. MASHAW, GREED, CHAOS, & GOVERNANCE: USING PUBLIC CHOICE TO IMPROVE PUBLIC LAW 156 (1997)).

[202] Wagner, *supra* note 8, at 279 (citing DONALD A. SCHON & MARTIN REIN, FRAME REFLECTION: TOWARD THE RESOLUTION OF INTRACTABLE POLICY CONTROVERSIES 171–72 (1994)); Doremus, *supra* note 62, at 414.

[203] "[Because] Congress's delegations to the agencies under these misframed [scientific] mandates are . . . scientifically infeasible, . . . agencies face the unenviable choice of doing nothing or lying about what they are doing and how they got there." Wagner, *supra* note 8, at 203. *See also* Doremus, *supra* note 12, at 1035.

[204] Doremus, *supra* note 12, at 1056; *see also id.* at 1129.

[205] Doremus, *supra* note 62, at 430.

[206] Doremus, *supra* note 12, at 1032; Doremus, *supra* note 62, at 437 ("[T]he agencies have not developed a coherent, consistent, transparent means of dealing with scientific uncertainty."). A similar charade played out in the U.S. Environmental Protection Agency's (EPA) setting of regulatory standards for pollutants:

> [T]he agency relied on obfuscation, using legalistic definitions and complex risk assessments to obscure the dissimilar treatment of similar risks. EPA set standards on an inconsistent, ad hoc basis. . . . But no matter how politically convenient, the use of obfuscation to avoid uniform regulation of similar risks provides a poor foundation for a stable regulatory system.

C. The ESA's Overreliance on Science

Thus, one of the primary shortcomings of the current ESA is its myopic reliance on science. Undoubtedly, science is the rock upon which species conservation and other natural resource management programs must be built.[207] Further, science has broad public appeal: "[d]ecisions attributed to science gain instant legitimacy through science's image as a pure pursuit above the concerns of the partisan political world."[208] However, when agencies are forced to make non-scientific decisions in the name of science—as the ESA requires them to do—they risk "undermin[ing] both political support for the protection of dwindling species and the credibility of science as a foundation for policy decisions."[209] A comprehensive and ultimately successful approach to species conservation requires recognition of the inherent uncertainties of science and an examination of the sometimes tense relationship between endangered species law and science.[210] The best place to begin such an examination is within the text of the statute itself.

1. Section 4 Listing Inquiries

Section 4 of the ESA requires a wildlife agency to make two inquiries in a listing determination: a taxonomic inquiry, and a viability inquiry.[211] The taxonomic inquiry requires the agency to determine whether a particular group of organisms comprises a "species" under the Act.[212] The viability inquiry requires the agency to determine whether a species is "endangered" or "threatened" under the Act.[213] Both of these inquiries require a

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Adam Babich, *Too Much Science in Environmental Law*, 28 COLUM. J. ENVTL. L. 119, 122–23 (2003). *See also* Emily Hartshorne Goodman, *Defining Wetlands for Regulatory Purposes: A Case Study in the Role of Science in Policymaking*, 2 BUFF. ENVTL. L.J. 135, 137 (1994) ("Striving for consistency from case to case is essential for equal justice.") (citations omitted).

[207] *See* Brunner & Clark, *supra* note 13, at 49; Wagner, *supra* note 8, at 187 n.24 ("Not surprisingly, . . . many environmental programs owe their birth, if not their entire existence, to a scientific consensus—developed through numerous, diverse studies—regarding a causal relationship between types of human activity and resulting environmental degradations."). *See also* Boersma et al., *supra* note 104, at 643 ("Science should be able to guide management actions intended to help species that are at risk of extinction."); Houck, *supra* note 2, at 428 ("[S]cience is more than able, and indeed is the best-qualified discipline available [in the environmental context of pollution control].").

[208] Doremus, *supra* note 12, at 1038.

[209] *Id.* at 1152–53.

[210] Donald Kennedy & Richard A. Merrill, *Science and the Law*, ISSUES IN SCI. & TECH. ONLINE, Summer 2000, http://www.issues.org/issues/16.4/kennedy.htm (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review).

[211] Doremus, *supra* note 12, at 1087–88.

[212] *Id.* at 1088.

[213] *Id.*

wildlife agency to look beyond ascertainable science and thus essentially compel the agency to contravene its strictly science mandate.[214]

a. The Taxonomic Inquiry[215]

Only 1.7 million of approximately ten million plant and animal species have been catalogued since the time of Carl Linnaeus.[216] Taxonomists, in the wake of national and international efforts to protect threatened and endangered species, have been flooded with requests to help resolve identification problems.[217] The demand for identification, however, begs the fundamental question: just what *is* a species?

Rather than giving the wildlife agencies carte blanche to list the entire diversity of life, Congress provided the agencies with a hazy definition by which to identify protectable groups.[218] The ESA's taxonomic[219] inquiry requires a wildlife agency to determine whether a group of organisms constitutes a "species." Congress only half-heartedly attempted to define what it means by this term: "The term 'species' 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."[220] Rather than clarifying what is a "species," the definition poses two further questions: (1) what is a "subspecies"?; and (2) what is a "distinct population segment" ("DPS")?[221]

Congress's inability to clearly state what groups of organisms it wished to protect,[222] as well as its inability to recognize that science alone cannot provide precise answers to species/subspecies/DPS definition quandaries, give rise to one of the inherent weaknesses of the ESA.[223] While Congress's

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214 *Id.*

215 A recent *New York Times* article discusses the emerging use of "DNA bar codes" in species identification. *See* Nicholas Wade, *A Species in a Second: Promise of DNA "Bar Codes,"* N.Y. Times, Dec. 14, 2004, at F1.

216 *Id.*

217 *Id.* Given current methods and rates of identification, "[Taxonomists] will need 1,196 years to complete the job." *Id.* (internal quotation omitted).

218 Doremus, *supra* note 12, at 1095.

219 Taxonomy involves the identification and classification of organisms. *Id.* at 1088 (citing Ernst Mayr, The Growth of Biological Thought: Diversity, Evolution, and Inheritance 32 (1982)).

220 16 U.S.C. § 1532(16) (2005).

221 Doremus, *supra* note 12, at 1089. By protecting these two subgroups, Congress may have intended to protect smaller groups that were valued for something other than their evolutionary potential. *Id.* at 1094. The DPS criterion was not intended to "authorize FWS to list the squirrels in a city park as a distinct population segment," but was rather intended to provide for listing "sparingly and only when the biological evidence indicates that such action is warranted." *Id.* at 1095 (quoting S. Rep. No. 95-151, at 7 (1979)).

222 It appears that Congress wanted to protect "at least distinct forms, genetic resources, and domestic populations," and understood that no one definition of species captured all these features. *Id.* at 1095.

223 *See id.* ("The protracted legislative wrangling over the ESA's most fundamental definition reflects the inability of the bare term 'species' to capture the nuances Congress

vague mandate has not caused too many problems in the species context (where most distinctions are well-settled within the taxonomic community), subspecies and DPS designations are inherently more subjective, more difficult, and have generated much more controversy.[224]

In the ESA context, the terms "species," "subspecies," and "distinct population segment" are intended to be terms of science. In reality, they are terms of art, intended to fulfill practical and sometimes political needs.[225] This is not to suggest that scientists should not be the ones to determine how best to define these terms in the ESA context. Indeed, there is no group better qualified to apply Congress's vague, generalized definition than scientists.[226] Recognizing the ambiguity does, however, demonstrate that defining these terms requires reaching beyond the realm of the known.

i. What Is a "Species"?

No universal definition of "species" exists.[227] One way of looking at the species concept is through an "essentialist" lens.[228] The essentialist approach, often taken by laymen, defines a species as a type of organism that is invariant and fundamentally distinct from other species.[229] Under the essentialist view, species are morphologically distinct from one another, as well as sexually incompatible.[230] While scientists' species definitions also have morphological and sexual components, they tend to reject the assumptions of invariability and fundamental difference.[231]

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sought to incorporate.").

[224] *See id.* at 1103–04. For example, NOAA Fisheries' November 17, 2000, decision to list the Gulf of Maine DPS of the Atlantic Salmon (*Salma salar*) as endangered was "controversial, with significant public support as well as opposition." 2000–2002 NMFS BIENNIAL REP., at 36, *available at* http://www.nmfs.noaa.gov/pr/readingrm/ESABiennial/2002bien.pdf. The United States District Court for the District of Oregon waded into the DPS quagmire with a 2005 decision involving the classification of the gray wolf. Defenders of Wildlife v. Sec'y, U.S. Dep't of the Interior, 354 F. Supp. 2d 1156 (D. Or. 2005). In that case, the court found arbitrary and capricious the Fish and Wildlife Service's decision to expand the boundaries of (i.e., to downlist) gray wolf DPSs. *Id.* at 1172. The decision was "not based on the present or future threats to the wolf or on the best available science." *Id.*

[225] Goodman, *supra* note 206, at 135 (citing United States v. City of Fort Pierre, 580 F. Supp. 1036, 1038 (D.S.D. 1983), *rev'd on other grounds*, 747 F.2d 464 (8th Cir. 1984) ("The term wetlands is not a term of pure science; it is a term that Congress defined and expected to be interpreted to satisfy a practical, social and political need.")).

[226] Goodman, *supra* note 206, at 138. *See* discussion in Part II.D.3, *infra*.

[227] *See* Ruhl, *supra* note 6, at 576 n.67. ("The scientific consensus on 'species' . . . is that no complete consensus exists and that different definitions suit different purposes.") (quoting Blake Hood, *Transgenic Salmon and the Definition of "Species" Under the Endangered Species Act*, 18 J. LAND USE & ENVTL. L. 75, 78 (2002)).

[228] Doremus, *supra* note 12, at 1089.

[229] *Id.*

[230] *Id.*

[231] *Id.* at 1089–90 (noting that scientific species classifications, while "rely[ing] on morphological and reproductive distinctions, . . . [are] largely stripped of their essentialist connotations" including the "view[ing] of species as invariant and fundamentally distinct from one another").

Scientists' species concepts generally incorporate evolutionary principles such as natural selection. The theory of natural selection is premised on the notion that organisms adapt and transform themselves over time. This notion of continual change undermines the assumption that one species abruptly stops where another starts.[232] Any line drawn to demarcate species is therefore going to be somewhat subjective.[233] Of course, the larger the evolutionary (and thus morphological and reproductive) distance between two groups of organisms, the easier it is to differentiate between them.[234] But drawing the line between more closely related groups is inherently arbitrary.[235]

Taxonomists commonly rely on Ernst Mayr's "biological species concept" (BSC) in their line-drawing efforts. The BSC incorporates an evolutionary component into species definition and relies primarily on sexual isolation to distinguish between species.[236] The BSC defines species as "'groups of actually or potentially interbreeding populations that are reproductively isolated from other such groups.'"[237] While the BSC definition is instructive, it is not universally applicable.[238] For example, by its very terms, it is inapplicable to asexually reproducing plants.[239] Nor is it applicable to "subspecies" or DPS determinations.[240] Thus, the ultimate choice of whether a group of organisms is a species, subspecies, or DPS is not scientific in the traditional sense but is rather a context-specific determination based on convenience, usefulness, or some other subjective factor.[241]

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[232] *Id.* at 1090 (noting Darwin's theory that "species are capable of gradual transformation to entirely new forms").

[233] *See id.* at 1090, 1098, 1102. From an evolutionary biology perspective, trying to define a species is "trying to define the undefinable." *Id.* at 1097. "Given political, economic, and even biological constraints, conservation planners are often forced to establish conservation priorities among evolutionary lineages. This necessity translates into difficult decisions about which traits should have primacy in establishing conservation priorities, or in extreme cases, deciding which groups are expendable." Ruckelshaus et al., *supra* note 12, at 677.

[234] Doremus, *supra* note 12, at 1102.

[235] Taxonomists generally fall into one of two categories with regard to defining species: (1) "lumpers" tend to group organisms into "large, inclusive taxa," and (2) "splitters," who use "minute distinctions" to justify separating taxa. *Id.*

[236] *Id.* at 1090, 1099 (citing Ernst Mayr, *Speciation Phenomena in Birds*, 74 Am. Naturalist 249 (1940) and Ernst Mayr, *What Is a Species and What Is Not*, 63 Phil. Sci. 262, 266 (1996)). Mayr focused on reproduction because of the fundamental role it plays in evolution and speciation. *Id.* at 1090.

[237] Stephen J. O'Brien & Ernst Mayr, *Bureaucratic Mischief: Recognizing Endangered Species and Subspecies*, 251 Sci. 1187 (1991).

[238] Doremus, *supra* note 12, at 1091.

[239] *Id.*

[240] For example, there is no objective way of determining what degree of reproductive isolation would be necessary to isolate a DPS, nor where on the morphological continuum one DPS ends and another begins. *Id.* at 1099.

[241] *Id.* at 1099–100. While the above discussion demonstrates that defining a "species" is not a purely scientific endeavor, the question of whether Congress intended that the strictly science mandate apply to species definition is open to debate. *Id.* at 1095–96. Per the text of Section 4, the strictly science mandate applies directly only to viability determinations. *Id.* Legislative history, however, at least indicates that Congress intended the

ii. What Is a "Subspecies"?

The term "subspecies" has no generally accepted biological meaning.[242] It generally refers to a division within a species that corresponds to geographical separation.[243] Wildlife agencies rely primarily on morphology and secondarily on genetic divergence in making subspecies determinations;[244] relying on genetic divergence allows the agencies to make their classification decisions appear technical and scientific.[245]

iii. What Is a "Distinct Population Segment"?

While the "population" concept is widely used by wildlife biologists,[246] the term "distinct population segment" is not found in the scientific literature (except with reference to the ESA).[247] Thus, wildlife agencies have had to fill the definitional gap. Wildlife agencies making DPS classifications have relied primarily on two factors: discreteness and significance. To be classified as a DPS, a group of organisms must be "discrete"; that is, it must be characterized by biological (i.e., physical, physiological, behavioral, or ecological) or political (i.e., international boundary) "marked separation."[248] Further, in order to qualify for DPS designation, a group of organisms must be deemed "significant" to the species.[249] A DPS can be

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agencies to rely primarily on science when defining protected groups of organisms. *Id.* at 1096. For example, a 1982 House report stressed that the strictly science mandate was being adopted to preclude economic considerations from affecting "any phase of the listing process"; presumably, determining whether a group of organisms is a "species" is part of the listing process and thus subject to the strictly science mandate. *Id.* (quoting H.R. Rep. No. 97-567, at 20 (1982)). This makes especial sense in light of a scientist's ability to manipulate species definitions to meet his ideological goals: the more small groups you delineate as species, subspecies, or DPSs, the more protection is possible. *Id.* at 1103. Whether agencies defer to a taxonomic consensus is often contingent upon whether such deference would further the agency's preferred course of action. *See id.* at 1112 (noting that while the wildlife agencies generally defer to the taxonomic community, they occasionally depart from taxonomic consensus); Primm & Clark, *supra* note 9, at 1040 (noting generally that "bureaucrats may act out their policy and ideological preferences through the implementation process"). While the agency may have valid reasons for its preferred course of action, those reasons may not necessarily be "scientific." Doremus, *supra* note 12, at 1112.

242 *Id.* at 1100–01.

243 One of the most well known subspecies classifications is the Kodiak brown bear (*Ursus arctos middendorffi*). This subspecies, the largest of all brown bears, ranges exclusively in the Kodiak Archipelago off of Alaska, where it has been geographically isolated for upwards of 12,000 years. *See* Alaska Department of Fish & Game: Wildlife Conservation Division, Kodiak Bear Fact Sheet, http://www.wildlife.alaska.gov/index.cfm?adfg=bears.trivia (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review).

244 Doremus, *supra* note 12, at 1105.

245 *See id.* at 1107 (noting that one reason agencies emphasize genetic divergence in the DPS context is to "make identification of population segments appear scientific").

246 Ruhl, *supra* note 6, at 576 n.67 (citing Hood, *supra* note 227, at 78) (the population concept is "generally accepted in science as an essential unit of genetic evolution").

247 Doremus, *supra* note 12, at 1101.

248 *Id.* at 1106.

249 *Id.* at 1105–06. The agencies' interpretation of significance has been criticized by

deemed significant if it is genetically distinct from other populations, if it inhabits a unique ecological setting, or if its loss would lead to a considerable gap in the species' historic geographical range.[250] Such determinations are not self-evident, however, and are frequently met with skepticism or even downright hostility.

For example, ESA opponents unleashed their fury when the FWS listed the coastal California gnatcatcher (*Polioptila californica*) as a threatened DPS.[251] The gnatcatcher listing decision rested primarily upon the petition and testimony of Dr. Jonathon Atwood, the lone expert on the relevant population.[252] Critics pointed to the fact that Dr. Atwood had, several years prior, published a report concluding that the California population was *not* taxonomically distinguishable from its Mexican counterparts.[253] Despite the fact that Dr. Atwood's new taxonomic interpretation had been explained in a peer-reviewed publication and was more consonant with the scientific community's prevailing position, critics contended that his sea change resulted not from a neutral evaluation of the best available science, but from his personal desire to see the species listed.[254]

b. The Viability Inquiry

The viability inquiry involves a determination of whether a species is endangered or threatened. No scientifically accepted biological definitions of "endangered" and "threatened" exist.[255] The ESA defines an "endangered" species as one that is in danger of extinction throughout at least a significant portion of its range;[256] a "threatened" species is one that, while not presently endangered, is likely to become so in the foreseeable future.[257] These definitions suggest the existence of some threshold viability level, but fail to specify what that threshold level is, how it should be determined, and over what time period the risk should be assessed.[258]

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environmentalists as being "unnecessarily crabbed" because it ignores any of the other ways a species might be significant in furthering ESA's values and goals. *Id.* at 1108.

[250] *Id.* at 1108.

[251] *Id.* at 1085.

[252] *Id.* at 1085–86.

[253] *Id.* at 1085.

[254] *Id.*

[255] *Id.* at 1113. For example, the International Union for Conservation of Nature and Natural Resources (IUCN) Red List subdivides the viability inquiry even further (extinct; extinct in the wild; critically endangered; endangered; vulnerable; near threatened; and least concern). *See* International Union for Conservation of Nature and Natural Resources, IUCN Red List Categories and Criteria: Version 3.1, 14–15 (2001), *available at* http://www.iucn.org/webfiles/doc/SSC/RedList/redlistcatsenglish.pdf.

[256] 16 U.S.C. § 1532(6) (2005).

[257] 16 U.S.C. § 1532(20).

[258] Doremus, *supra* note 12, at 1113, 1117. The ESA's text and legislative history indicate that a group of organisms must face more than a *de minimis* threat, and that survival of the group is likely contingent upon listing and protection. The more immediate the threat, the greater the protection warranted. *Id.* at 1116, 1117.

Thus, once again, it remains up to the wildlife agencies to determine how to proceed.[259]

i. A "Strictly Science" Determination

As alluded to in Parts III.A and III.B.2.d.i *supra*, Congressional assignment of power to expert scientific agencies is not unusual in and of itself.[260] What makes the viability inquiry of the ESA unique is that it requires agencies to make discretionary determinations strictly on the basis of science, while at the same time "[i]t is impossible to specify a viability level . . . without looking *beyond* the realm of science."[261] While the wildlife agencies may insist that viability determinations are not themselves political, "it has long been clear that political factors sometimes do affect at least the timing, if not the substantive outcome, of listing decisions."[262]

ii. The Wildlife Agencies' Approach

NOAA Fisheries' approach to viability analysis involves a subjective determination of what degree of risk "is too high to be acceptable to society."[263] While admitting the subjective nature of the risk determination, NOAA Fisheries defers to conservation biologists' viability standard of a 95% chance of survival over a 100-year time period.[264] NOAA Fisheries considers numerous factors in its viability assessment, including historic population levels, current population levels, population trends, carrying capacity, threats to genetic integrity, and other factors likely to lead to population variability over time.[265] The FWS considers many of the same factors, as well as habitat degradation and vulnerability to known or potential threats.[266]

2. The Manipulability of the "Science" Concept

One of the strongest criticisms of the ESA's overreliance on science is that the concept of "science" is easily manipulated by all sides in the rhetorical environmental debate.[267] Environmentalists claim that the wild-

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[259] *Id.*
[260] *Id.* at 1117.
[261] *Id.* (emphasis added).
[262] *Id.* at 1122.
[263] *Id.* at 1123 (quoting Change in Listing Status of Steller Sea Lions Under the Endangered Species Act, 60 Fed. Reg. 51,968, 51,971 (Oct. 4, 1995)).
[264] *Id.*
[265] *Id.* at 1124.
[266] *Id.*
[267] Adler et al., *supra* note 35, at 17 ("Parties often use scientific and technological issues as a strategic or tactical 'weapon.'"); Tarlock, *supra* note 14, at 136 ("[A]ll too often the parties seek to support their individual and self-interested positions by resorting to a single view of science and discrediting the science justifications invoked by their oppo-

life agencies are failing to heed the steps science shows to be necessary for species protection.[268] Non-environmental interests complain that failure to aggressively apply the scientific method is hindering economic activity.[269] Politicians characterize inherently value-laden, difficult decisions as "scientific" so they can pass the buck to scientific experts.[270] All these groups' appeals can be disingenuous and manipulative, and can undermine the legitimacy of real science in the long run.[271]

There is no doubt that science provides the baseline knowledge resource managers need to make conservation decisions. However, science does not provide fixed rules on how to extrapolate this baseline knowledge to answer larger policy questions, such as how much conservation is needed and how much risk we are willing to tolerate.[272] Thus, while science is necessary for effective policy-making—to properly assess the risk status of a species, evaluate historical trends (ecological, social, economic, and political)[273] and current conditions, project future trends, and develop appropriate conservation policies[274]—science alone is not sufficient.[275]

a. Never "Enough" Science

First, in the species conservation context, there is never "enough" science available when a decision needs to be made.[276] Even for a well-known species like the grizzly bear (*Ursus arctos horribilis*), scientists

nents."); Goodman, *supra* note 206, at 159 ("[W]hen value choices are involved the claim that 'science is on my side' should not be credited.").

[268] Doremus, *supra* note 12, at 1032.

[269] *Id.*

[270] *Id.* at 1038–39 ("[C]haracterizing a decision as strictly scientific can allow politicians to evade difficult value choices, placing those choices instead in the hands of technical experts. Not surprisingly, political appeals to science are often disingenuous; politicians who describe policy choices as scientific are often more interested in cloaking their favored policies with the prestige of science than in choosing policies which accurately reflect scientific knowledge."). "[T]he 'leave it to the scientists' solution is viewed as both intellectually superior and politically safer than resolving issues through painful public debate." Wagner, *supra* note 8, at 235.

[271] *See* Doremus, *supra* note 12, at 1038, 1040. *See also* Part V.B.2, *infra*.

[272] Brennan et al., *supra* note 6, at 410. "Values inform decisions about how to extrapolate study results, yet little effort is made to make these value choices explicit." Wagner, *supra* note 8, at 189.

[273] *Policy-Oriented Curricula*, *supra* note 8, at 36.

[274] *See id.*; Primm & Clark, *supra* note 9, at 1038; Brunner & Clark, *supra* note 13, at 52.

[275] Clark, *supra* note 9, at 51 (citing S. Viederman et al., *The Role of Institutions and Policymaking in Conservation*, *in* PRINCIPLES OF CONSERVATION BIOLOGY 545, 574 (Gary K. Meffe & C. Ronald Carrol eds., 2d ed. 1997). It has been observed that "science alone does not have and never will have solutions to the fundamental environmental problems of our time, which are religious in the largest sense of the word, dealing as they do with values and the human spirit." Brunner & Clark, *supra* note 13, at 53 (citations omitted).

[276] Clark, *supra* note 9, at 51. *See also* Elizabeth E. Holmes, *Estimating Risks in Declining Populations with Poor Data*, 98 PROC. NAT'L ACAD. SCI. 5072, 5072 (2001) ("Census data on endangered species are often sparse, error-ridden, and confined to only a segment of the population.").

lack key population viability information.[277] For lesser known species such as the wolverine (*Gulo gulo*), information on population status, survival requirements, and habitat suitability is "virtually nonexistent."[278] Scientists face technical problems too: for example, habitat models are not yet flexible enough to reflect macrospatial and temporal habitat-use patterns.[279]

What it boils down to is that, where endangered or threatened species are concerned, we often simply do not have comprehensive data. Yet practical necessity and endangered species law do not allow us to postpone species conservation issues indefinitely pending better scientific knowledge.[280] Under the current emergency-room ESA framework, if we are to act, we must act *now*, even when the science is unavailable.

b. Value Choices

This brings us to the second limitation of science: even if the science is available, it cannot tell us what we *should* do with what scientific information we have; it cannot tell us whether and how we *should* act with respect to any given species. Species conservation is a moral problem that requires us to determine what is most appropriate in a given context.[281] Unfortunately, the "myth about the power of science and knowledge is pursued without sufficient acknowledgement that, irrespective of the nature and validity of research findings, political circumstances will often be the determining factor in decision making."[282]

In truth, ESA conflicts do transcend science. The conflict is often cultural, rooted in differing values: protectionism versus resource extraction; urban versus rural values; states' rights versus federal power.[283] Appeals to science will not justify species protection to those who value private

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[277] Primm & Clark, *supra* note 9, at 1038. For more information on the difficulties of grizzly bear conservation, and an overview of why adaptive management is appropriate in the grizzly bear conservation context, see R. Edward Grumbine, *What Is Ecosystem Management?*, 8 CONSERVATION BIOLOGY 27, 28–29 (1994); David J. Mattson et al., *Science and Management of Rocky Mountain Grizzly Bears*, 10 CONSERVATION BIOLOGY 1013 (1996).

[278] Primm & Clark, *supra* note 9, at 1038 (citations omitted).

[279] *But see* Ruckelshaus et al., *supra* note 12, at 690 ("[T]echnical challenges are a small part of the overall task of developing a recovery plan.").

[280] Brunner & Clark, *supra* note 13, at 56. Nor does the structure of our judicial system tolerate indefinite delay. "Courts must determine the rights of individuals on the basis of the information available at the moment of the decision and generally do not have the luxury of correcting their decisions as new information becomes available." Doremus, *supra* note 62, at 412.

[281] Brunner & Clark, *supra* note 13, at 51. "Morality is rarely a matter simply of applying an unquestioned principle to a case that indubitably falls under its scope. The moral problem is to weigh conflicting principles and to act on a balance of probabilities on behalf of preponderant values." *Id.* (citing ABRAHAM KAPLAN, AMERICAN ETHICS AND PUBLIC POLICY 91 (1963)).

[282] Clark, *supra* note 9, at 48.

[283] Primm & Clark, *supra* note 9, at 1037 (internal citations omitted). For example, opposition to Rocky Mountain wolf reintroduction was largely rooted in hostility toward federal control over wildlife resources. *Id.*

property rights, the free market, liberty, or freedom above conservation.[284] Biology, ecology, law, economics, political science, and sociology are just some of the many disciplines that have a place in conservation decisions.[285] It is within a complex multidisciplinary framework that decisions are made about whether a species will live or expire.[286] Understanding the multidimensional nature of resource management is crucial to improving endangered species policy.[287]

3. *Getting Out of the E.R.*

Another shortcoming of the ESA is that it is a reactionary piece of legislation that waits until the situation hits crisis-level before responding.[288] This emergency-room mentality means that often we treat the symptom (e.g., decline in species population) rather than the disease (e.g., overexploitation, habitat loss).[289] While such an approach may allow us to stave off some species extinctions in the short-term, it is not the best way to achieve our long-term goals of species conservation and ecosystem protection (assuming those are and will continue to be the true goals of our environmental legislation). A truly successful approach to species conservation must incorporate ecosystem principles in the broad sense; in other words, it must include the human race as an integral part of those systems.[290]

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[284] *See* Brunner & Clark, *supra* note 13, at 51. *See also* Adler et al., *supra* note 35, at 17:

> Environmental disputes are rarely caused by scientific and technical information *per se*. Most often, they tend to be about (a) perceived or actual competition over interests; (b) different criteria for evaluating ideas or behaviors; (c) differing goals, values and ways of life; (d) misinformation, lack of information, and differing ways of interpreting or assessing data; and/or (e) unequal control, power, and authority to distribute or enjoy resources.

[285] *Leadership*, *supra* note 8, at 10.

[286] As opposed to species and ecosystem science, which focus on the attributes and behaviors of the biotic and abiotic systems, species and ecosystem *management* focus on ongoing human decision-making processes. Clark, *supra* note 3, at 21.

[287] Clark, *supra* note 9, at 37. "[I]t seems unrealistic to think that one can entirely separate scientific advice from policy, either in theory or in practice." Noah, *supra* note 21, at 1064.

[288] "As a result of the fiscal and political barriers to listing, most species do not reach the protected list until their populations are extremely reduced. It is widely agreed that the inability to provide protection before the late stages of decline is a serious failing of the ESA." *See* Doremus, *supra* note 62, at 402–03.

[289] This type of approach is "solution-oriented" rather than "problem-oriented." Clark, *supra* note 9, at 39.

[290] "[I]t is necessary to recognize that human social systems and ecological systems have co-evolved and that dealing with problems in one system affects the other system." Clark, *supra* note 9, at 50. Ecosystem management, with its wholly biocentric focus, thus rejects the ecologically erroneous "separatist intuition" that regards humans as separate from nature. Jonathan Baert Wiener, *Law and the New Ecology: Evolution, Categories, and Consequences*, 22 Ecology L.Q. 325, 340–45, 356 (1995). Indeed, "'[T]here is no longer any part of the Earth that is untouched by our actions in some way, either directly or indirectly.'" *Id.* at 347 (quoting Daniel B. Botkin, Discordant Harmonies: A New Ecol-

If we fail to recognize this human dimension, we risk overlooking the "subtle nuances of the cultural environment, which may be one fundamental cause of species endangerment in the first place . . . ."[291] Indeed, the cause of any species endangerment problem will almost invariably be related to human activity.[292]

Unfortunately, the ESA does not allow resource managers to tackle the underlying ecosystem-based problems that have led to species imperilment. In fact, the Ninth Circuit explicitly rejected the permissibility of such an approach in *Arizona Cattle Growers' Ass'n v. United States Fish & Wildlife Service*.[293] In that case, the FWS had issued take statements that effectively restricted cattle grazing in certain areas on the theory that the habitat destruction caused by the grazing might harm endangered species.[294] The FWS argued for a broad interpretation of Section 7; specifically, it argued that a Section 7 taking "should encompass those situations in which harm to a listed species was 'possible' or 'likely' in the future due to the proposed action."[295] The agency was attempting to get out of the emergency room mentality by adopting a broad, long-range vision for recovery. The Ninth Circuit rebuffed FWS's attempt, finding that the ESA limits what the agency can do to avoid jeopardy and take.[296]

Thus, while the wildlife agencies and the courts both seem to recognize the ESA's failure to take a long-term, comprehensive approach to species conservation, they are unable under the current statutory regime to act on that knowledge. To move forward in our species conservation efforts, we must let go of our "unwavering commitment to one initial policy," i.e., the current ESA regime.[297] A more inclusive, multidisciplinary, and flexible process, founded in good science and appreciative of people's place within a given ecosystem, will not only enjoy broader public support but will also be more effective in achieving species and ecosystem conservation goals.[298]

IV. Where Do We Go from Here?

Few on either side of the debate doubt that the ESA has its shortcomings and should probably be amended. Those concerned about species pro-

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ogy for the Twenty-First Century 194 (1990)).

[291] Muchnick, *supra* note 92, at 109.

[292] *Policy-Oriented Curricula*, *supra* note 8, at 33 (commenting that "the ultimate causes of biodiversity loss . . . are nearly always related to humans").

[293] 273 F.3d 1229 (9th Cir. 2001).

[294] *Id.*

[295] *Id.* at 1237.

[296] *Id.* ("We believe that Congress has spoken to the precise question at issue and agree with the district court that the definition of 'taking' in Sections 7 and 9 of the ESA are identical in meaning and application.").

[297] Clark, *supra* note 9, at 41.

[298] *Id*. at 46. If the regime is not modified, "implementation will [continue to] be weak, lawsuits will [continue to] proliferate, and the [species protection] effort will go on with little consensus or resolution." *Id.*

tection, however, fear that any changes made right now—given this President and this Congress—will gut the Act rather than strengthen species protection.[299] According to Jamie Rappaport Clark, former FWS director and current Defenders of Wildlife Executive vice president, "There are some changes that are appropriate to be made . . . . The question is whether you can navigate appropriate changes that advance species conservation in this political climate."[300] Given the need for change, but given a potentially hostile political climate, just where exactly should we go from here?

A. Where We Shouldn't Go . . .

1. A Political Route

> Assaults on science have, of course, been common over the past several hundred years. But the Bush Administration's pervasive, ideologically based science policy . . . appears to be unprecedented in the United States.[301]

It has been said that "[s]cientific uncertainties provide scientifically sophisticated [politicians] splendid opportunities to advance their own political goals without detection."[302] It appears that, with respect to environmental policy, the Bush Administration and the current Congress are taking advantage of just such opportunities.[303] According to critics, the Administra-

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[299] A concern borne out with the introduction of the Threatened and Endangered Species Recovery Act of 2005. *See* Part IV.A.2.e, *infra*. *See also* Staff & Wire Reports, *supra* note 2.

[300] *Id.*

[301] McDaniel, *supra* note 54, at 869. *See also* Natural Resources Defense Council, Bad Science and the Bush Record, http://www.nrdc.org/bushrecord/science/default.asp (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review) (criticizing and providing examples of the Bush Administration's "distorting science to weaken regulations so as to serve its political objectives"); Robert F. Kennedy, Jr., *The Junk Science of George W. Bush*, NATION, Mar. 8, 2004, at 11 (commenting that the Bush Administration is "engaged in a campaign to suppress science that is arguably unmatched in the Western world since the Inquisition.").

[302] Wagner, *supra* note 8, at 229.

> Scientifically sophisticated public choice legislators can also exploit the knowledge gap by converting the uncertainties into a debate over good science. This approach can be used by those on either side of the environmental policy debate. Rather than calling attention to the knowledge gaps, this legislator obfuscates them still further by summoning hand-picked experts to present scientific-sounding arguments that support the legislator's position. In reality the experts' technical arguments are not more than window dressing designed to hide the congressmember's underlying, politically vulnerable, policy preferences.

Id. at 230–31.

[303] For example, despite overwhelming scientific evidence to the contrary that human activities are contributing to global warming (*see, e.g.*, COMM. ON THE SCI. OF CLIMATE CHANGE, NAT'L RESEARCH COUNCIL, CLIMATE CHANGE SCIENCE: AN ANALYSIS OF SOME

tion continually manipulates the definitions of what science is and what it can do to achieve partisan ends.[304]

Since George W. Bush came into office in 2001, numerous parties have criticized the President and his Administration for subverting science.[305] Congressman Henry Waxman (D-Cal.) "issued a report excoriating the Administration's manipulation of science in a variety of contexts, including . . . environmental and natural resources . . . policy."[306] Scientists' exasperation with the Administration became evident last year when—in nontraditional partisan fashion—forty-eight Nobel laureates signed a letter endorsing Senator John Kerry for President.[307] Even some Bush supporters have expressed concern over Bush's science-based policies; for example, Senator John McCain (R-Ariz.) called the current global warming policy "terribly disappointing."[308]

KEY QUESTIONS 1 (2001), *available at* http://print.nap.edu/pdf/0309075742/pdf_image/1.pdf ("[G]reenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures to rise. Temperatures are, in fact, rising. The changes observed over the last several decades are most likely due to human activities.")), the Bush Administration has reneged on a campaign pledge to reduce CO_2 emissions from power plants; withdrawn the United States from the Kyoto protocol; deleted the climate change portion from the EPA's 2002 annual air pollution report; suppressed information on mercury emissions from coal-fired power plants; altered scientific data and protocols data provided by the Centers for Disease Control; and stood poised to revise down the standard for acceptable levels of lead in children's blood. McDaniel, *supra* note 54, at 870.

[304] This type of manipulation is not unique to this administration. Associate Professor Wendy Wagner points out that "Congress . . . regularly neglect[s], ignore[s], or deliberately manipulate[s] the scientific uncertainties that are commonplace in environmental problem solving." Wagner, *supra* note 8, at 286.

[305] Specifically, the Bush Administration has been accused of "select[ing] or suppress[ing] research findings to suit preset policies, skew[ing] advisory panels or ignor[ing] unwelcome advice, and quash[ing] discussion within federal research agencies." Andrew C. Revkin, *Bush vs. the Laureates: How Science Became a Partisan Issue*, N.Y. TIMES, Oct. 19, 2004, at F1. *See also* Cornelia Dean, *Park Service Under Attack by Adviser*, N.Y. TIMES, Oct. 29, 2004, at A16 (describing another example of the Bush Administration subverting science; specifically, its withholding of a Report on biological diversity and ecological integrity in National Parks); Victoria Sutton, *The George W. Bush Administration and the Environment*, 25 W. NEW ENG. L. REV. 221, 222 (2003) (Generally supporting the Bush Administration's environmental policies, but noting that "[t]he Bush Administration has been accused of having the 'worst environmental record since our most important environmental regulations became law[.]'" (quoting Editorial, *Timber Policy Reflects President's World View*, S.F. CHRON., Aug. 26, 2002, at B4)). For a discussion of the Administration's manipulation of science in the Klamath Basin context, discussed *infra*, see DEMOCRATIC STAFF, COMM. ON RES., U.S. HOUSE OF REPRESENTATIVES, WEIRD SCIENCE: THE INTERIOR DEPARTMENT'S MANIPULATION OF SCIENCE FOR POLITICAL PURPOSES 5 (2002), *available at* http://resourcescommittee.house.gov/resources/democrats/pr2002/weirdscience.pdf.

[306] *See* Doremus, *supra* note 62, at 400 (citing MINORITY STAFF, SPECIAL INVESTIGATIONS DIV., COMM. ON GOV'T REFORM, U.S. HOUSE OF REPRESENTATIVES, POLITICS AND SCIENCE IN THE BUSH ADMINISTRATION (2003), *available at* http://www.house.gov/reform/min/politicsandscience/pdfs/pdf_politics_and_science_rep.pdf.

[307] Revkin, *supra* note 305. Some of those signing the letters were members of former Republican administrations. *Id.*

[308] Chris Mooney, *Science Wars: The Election Is Over, but the Bush Administration's Battles with the Scientific Establishment Aren't Going Away*, BOSTON GLOBE, Nov. 21, 2004, at K1. The global warming controversy arose again in October of 2004, when the government's pre-eminent climatologist Sean O'Keefe came forward, admitting he had been

Commentators have predicted that the Bush Administration's second term will be a watershed mark for our nation's environmental policy.[309] The ESA in particular may see a "rigorous shaking out."[310] Over its twenty-one-year history, the ESA has proven to be a strong source of protection for both species and their habitats. As such, it has come under attack by some in the Bush Administration and Congress, who feel the Act places too many restrictions on developers, ranchers, and farmers.[311]

Emboldened by their increased strength in both the House and the Senate, ESA opponents believe now is the time for some "common-sense reform" of the Act.[312] Those in favor of such reform frequently extol "sound science"[313] as the way to solve our endangered species crisis.[314] According to proponents, use of "sound science" will ensure that "definitive" scientific research precedes any agency wildlife action.[315] What they neglect to men-

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instructed not to publicly discuss humans' contribution to global warming. Editorial, *Subverting Science*, N.Y. TIMES, Oct. 31, 2004, § 4, at 10.

[309] Brad Knickerbocker, *Bush's Second-Term Stamp on Environment*, CHRISTIAN SCI. MONITOR, Nov. 18, 2004, at 2.

[310] *Id.* Such a shaking out would end the Congressional inertia toward the ESA, which has not been amended in a meaningful way in over twenty years. Ruhl, *supra* note 6, at 557. Already the Administration is demonstrating its dislike for the ESA's critical habitat provision by proposing to withdraw critical habitat designation for salmon (*Oncorhynchus* spp.) and steelhead (*O. mykiss*) habitat in the Pacific Northwest; Congress is expected to entertain proposals to radically alter or completely eliminate ESA's critical habitat requirement. Robert McClure, *Bush Administration Proposes 80% Cutback in Protected Salmon Habitat*, SEATTLE POST INTELLIGENCER, Dec. 1, 2004, *available at* http://www.fwee.org/news/getStory?story=1318.

[311] Knickerbocker, *supra* note 309. Contrary to what the current administration may believe, the repercussions of a "sound science" mandate might be more devastating to rural and industrial interests as a direct result of its delaying propensities. Wagner, *supra* note 8, at 263. For example, the spotted owl/old growth controversy was characterized by extraordinarily protracted and contentious debates. "As debates over scientific issues [relating to this controversy] dragged on, the unmanaged harvesting that proceeded during the interim closed off some of the most attractive options for achieving peaceful coexistence between environmental and timber interests." *Id.* at 263 (citing STEVEN LEWIS YAFFEE, THE WISDOM OF THE SPOTTED OWL: POLICY LESSONS FOR A NEW CENTURY 192, 201 (1994)).

[312] Staff & Wire Reports, *supra* note 2. Sen. James Inhofe (R-Okla.; Chairman of the Senate Environment and Public Works Committee), Sen. Mike Crapo (R-Idaho; chairman of the subcommittee with oversight of the ESA), and Richard Pombo (R-Cal.; House Resources Committee Chairman) are just some of the Congressmen who are pushing for reform. *Id.*

[313] *See* Dan Vergano, *Hook, Line, and Sinker*, USA TODAY, Apr. 22, 2003, at 8D ("Among critics, sound science has come to mean the selective use of [empirical] data to justify a certain agenda.").

[314] It is telling to note, however, that while the Administration has pushed for "sound science" when it supports its desired ends, it is not above calling on the alternative "best science available" (BSA) standard when it better suits the Administration's needs. For example, the Administration said that Forest Service officials could rely on the BSA standard—rather than more stringent standards requiring the maintenance of "viable populations" of species—to guide their decisions in managing wildlife in National Forests. Associated Press, *Environmentalists Sue Over Changes in Wildlife Protections*, MISSOULIAN, Oct. 27, 2004, *available at* http://www.missoulian.com/articles/2004/10/27/mtracker/news/41environmentalists.prt.

[315] *See* Wagner, *supra* note 8, at 229. According to John Graham, the Bush Administration's "point man" on sound science, "it is important that (scientific) claims . . . be replicated before they drive public policy." Vergano, *supra* note 313. As discussed above, how-

tion is that the burden of "definitive" proof is nearly impossible to achieve in the laboratory of nature.[316] Even Bush's science advisor, Dr. John H. Marburger III, acknowledges that environmental science is inherently murkier than a hard science like physics.[317]

2. *Down the "Sound Science" Path*

The Bush Administration is not the first to try to add so-called "sound science" requirements to environmental legislation. During the 1978 ESA Amendment discussions, which took place in the wake of *Tennessee Valley Authority v. Hill*,[318] Utah Republican Senator Jake Garn unsuccessfully pushed for an amendment requiring that listing determinations be based on "sound" scientific data.[319]

a. *The Endangered Species Conservation and Management Act of 1995*

The Endangered Species Conservation and Management Act of 1995 (ESCMA),[320] also known as the "Young-Pombo Bill," represents one significant attempt to amend the ESA.[321] Title III of the ESCMA, entitled "Improving Scientific Integrity of Listing Decisions and Procedures," would have changed the way the wildlife agencies evaluated and used scientific data in three primary ways.[322] First, it provided an explicit statutory bias favoring empirical data over modeling in listing decisions.[323] Secondly, it explicitly defined "best scientific data available" (as applied to both listing and jeopardy determinations) as "factual information, including but not limited to peer reviewed scientific information and genetic data, obtainable from any source, including governmental and nongovernmental

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ever, this approach is inappropriate in an applied science context like conservation biology—especially in the context of endangered species—where replication is often practically impossible. "A 'Best Science' document by the American Fisheries Society calls the Klamath River an example of the downside of sound-science rules: While regulators wait for peer-reviewed studies, endangered species may expire." *Id.*

[316] Just as troubling is that these sound science initiatives allow politicians, rather than scientists, to define science. *See, e.g.*, Vergano, *supra* note 313. ("Political battles surrounding scientific questions are nothing new, but a new debate has emerged in recent years over 'sound science,' a phrase used by both Presidents Clinton and Bush to describe the basis of their administrations' regulatory decisions. Not a term used by scientists, sound science has come to mean new rules for determining what kind of scientific evidence can be used to shape regulations.").

[317] Revkin, *supra* note 305.

[318] 437 U.S. 153 (1978) (enjoining completion of the largely constructed Tellico Dam to avoid jeopardizing the endangered snail darter (*Percina tanasi*)).

[319] Doremus, *supra* note 12, at 1052.

[320] H.R. 2275, 104th Cong. (1995).

[321] Brennan et al., *supra* note 6, at 433.

[322] *Id.*

[323] "The Secretary . . . shall accord greater weight, consideration, and preference to empirical data rather than projections or other extrapolations developed through modeling." H.R. Rep. No. 104-778(I) § 301 (a)(1)(A) (1996).

sources, which has been to the maximum extent feasible verified by field testing."[324] Third, it created a statutory peer review process for listing determinations.[325] While the ESCMA initiative was ultimately unsuccessful, its scientific data provisions resurfaced in 2000 and 2002.[326]

b. The Common Sense Protections for Endangered Species Act of 2000

Congress again attempted to amend the scientific data requirements of the ESA in the Common Sense Protections for Endangered Species Act of 2000 ("CSA").[327] The CSA provided an identical definition for "best scientific data available" (again applicable to both listing and jeopardy determinations) as that found in the ESCMA.[328] The CSA also required that the Secretary, in making listing determinations, take into account not only the threatened or endangered status of a species but also whether any conservation efforts were being made with respect to the species by other entities.[329]

c. The Sound Science for Endangered Species Act Planning Act of 2002

The Sound Science for Endangered Species Act Planning Act of 2002 (Sound Science Act) represents another recent Congressional attempt to significantly amend the ESA.[330] The legislative history of the Sound Science Act reflects that Congress is dissatisfied with the present level of wildlife agency control over the meaning of the "best scientific data available" standard:

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[324] *Id.* § 301(b)(1).

[325] *Id*. § 301(e)(2) ("Each regulation proposed by the Secretary to implement a [listing] determination . . . shall be based only upon peer-reviewed scientific information obtainable from any source, including governmental and nongovernmental sources, which has been to the maximum extent feasible verified by field testing.").

[326] Brennan et al., *supra* note 6, at 434.

[327] H.R. 3160, 106th Cong. (2000).

[328] H.R. Rep. No. 106-1013, at 22 (2000).

[329]

> The Secretary shall make [listing] determinations . . . on the basis of the [best] scientific and commercial data available to him after conducting a review of the status of the species and after taking into account those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction, or on the high seas.

Id. at 23.

[330] H.R. 4840, 107th Cong. (2002).

> Implementing [the best scientific and commercial data available] mandate has been problematic, however, primarily because there are no definitions in either the ESA or the accompanying regulations as to what constitutes the "best" or "available" information. The responsible agencies have complete discretion over these terms and have defined and used them to their advantage.[331]

The Sound Science Act would have purportedly "fixed" this problem by incorporating the following definition of "best science" into the ESA: "data that had been collected by established standards or protocols, properly analyzed, and then peer-reviewed before published or released to the public."[332]

The Sound Science Act would also have: (1) created a statutory preference for empirical, field-tested, or peer reviewed data; (2) required the FWS to promulgate mandatory criteria that scientific and commercial data must meet before it can be used in listing determinations; and (3) required supporting field data before any species could be listed.[333] Finally, the Sound Science Act implemented a formal peer review process.[334] Per this peer review process, every ESA determination would be referred to a five-member independent review board, which would issue an opinion on the wildlife agency's action within ninety days.[335] The board's final report would become part of the final rulemaking report (though the wildlife agency was not to be bound by it).[336]

The Sound Science Act, while denounced by numerous environmental interest groups, was generally supported by the FWS.[337] The FWS described the Sound Science Act's peer review requirements as robust, flexible, and devoid of politics.[338] Further, they believed that the proposed Act would

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[331] Brennan et al., *supra* note 6, at 438–39 (quoting H.R. Rep. No. 107-751, at 6 (2002)).

[332] H.R. Rep. No. 107-751, at 6.

[333] Brennan et al., *supra* note 6, at 439 (citing H.R. 4840 §§ 2(b), 2(d)(10), 2(d)(11)(A)).

[334] Brennan et al., *supra* note 6, at 440 (citing H.R. 4840 § 3(j)(4)(B)). *See also* Am. Inst. of Biological Sci., Public Policy Report (2002), http://www.aibs.org/public-policy-reports/public-policy-reports-2002_03_15.html (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review) (referring to the "sound science" approach and the peer-review process as the next "battering ram" against conservation policies).

[335] Brennan et al., *supra* note 6, at 440 (citing H.R. 4840 §§ 3(j)(3)(B), 3(j)(4)(A)). Many of the proposed amendments to the ESA emphasize the importance of peer review and independent advisory panels. *See* Doremus, *supra* note 62, at 400 ("[T]he Bush Administration [trumpets] the value of increased peer review to improve the science of regulatory decisions."). But it is important to recognize that when the fundamental ESA conflict really reflects conflicting *values*, an independent scientific panel is no better equipped to solve that problem using "science" than is the agency. As a result, these scientists may "'produce[ ] a lot of good science [that is] . . . largely irrelevant to the policy decisions.'" Wagner, *supra* note 8, at 216 (quoting Edward S. Rubin et al., *Keeping Climate Research Relevant*, 8 Issues Sci. & Tech., Winter 1991-92, at 48.

[336] Brennan et al., *supra* note 6, at 440 (citing H.R. 4840, §§ 3(j)(5), 3(j)(6)).

[337] Brennan et al., *supra* note 6, at 437, 438.

[338] *Id.* at 437. The Sound Science Act named the National Academy of Sciences standards as the baseline for the peer review process. *Id.*

provide for a more open, inclusive, and deliberative process among all interested stakeholders.[339] The FWS did express concern, however, regarding the additional workload and costs which the amendments would impose on the already understaffed and underfunded agency.[340]

d. Endangered Species Listing and Delisting Process Reform Act of 2003

The Endangered Species Listing and Delisting Process Reform Act of 2003 (Listing Reform Act) represented the 108th Congress's attempts to amend the ESA and "fix" the scientific data standard.[341] Introduced by Senators Craig Thomas (R-Wyo.), Larry Craig (R-Idaho), and Chuck Hagel (R-Neb.), the Listing Reform Act—as its name suggests—targets listing decisions. The Listing Reform Act required that a party seeking to list a species provide specific information, including at least one credible expert opinion, before its petition could be granted.[342] The proposed Act also required, *inter alia*: (1) state notification of a proposed listing;[343] (2) additional public hearings in the listing process;[344] (3) the existence of "an imminent threat to the [species'] continued existence" prior to an emergency listing;[345] (4) promulgation by the wildlife agency of criteria for determining the acceptability of scientific and commercial data;[346] (5) the required use of field data in listing decisions;[347] and (6) specific requirements for recovery plans and delisting decisions.[348]

e. Threatened and Endangered Species Recovery Act of 2005

George W. Bush's 2004 Presidential election victory set the stage for another wave of ESA reform attempts.[349] Whispers of renewed attacks on the ESA became a reality on September 19, 2005, when House Resources Committee Chairman Richard Pombo (R-Cal.) introduced the Threatened

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[339] *Id.*

[340] *Id.* at 437–38; *see also id.* at 438 n.247; Doremus, *supra* note 62, at 446.

[341] S.369, 108th Cong. (2003).

[342] Brennan et al., *supra* note 6, at 440–41 (citing S.369 2(c)).

[343] S.369 § 2(c).

[344] *Id.* § 2(d).

[345] *Id.* § 2(e). This threshold is higher than the current standard of "a significant threat to the [species'] well-being." Brennan et al., *supra* note 6, at 441 n.263.

[346] S.369 § 2(f).

[347] *Id.* § 2(f).

[348] *Id.* §§ 3, 4.

[349] The Threatened and Endangered Species Recovery Act of 2005 (TESRA) is only one of the draft ESA reform bills that were circulated in the summer of 2005. Another proposal would have "put even greater restrictions [than the TESRA] on federal agencies that enforce the law, and which would have automatically taken the law off the books in 2015." Felicity Barringer, *House Bill Would Limit U.S. Power to Protect Species*, N.Y. Times, Sept. 20, 2005, at A17.

and Endangered Species Recovery Act of 2005 (TESRA).[350] The TESRA quickly passed Committee review, and on September 29, 2005, it passed the House of Representatives by a vote of 229 to 193.[351] The Bush Administration formally supported the bill several hours before the House vote.[352]

Representative Pombo and other ESA opponents have declared their intentions "to strengthen the scientific judgments upon which agencies act by requiring listings to meet more rigorous standards of evidence,"[353] and the TESRA wastes no time attacking the ESA's "best available science" mandate. Section 3 of the TESRA gives the Secretaries of the Interior and Commerce the power to define the best available science.[354] It thus takes the power to determine what constitutes acceptable science away from wildlife agency scientists and experts and puts it in the hands of political appointees. Section 3 also mirrors other sound science initiatives insofar as it emphasizes the importance of empirical observations and peer review.[355]

The TESRA defies ecological sensibilities in several other sections throughout its text. First, it redefines "jeopardy" to mean an "action [that] reasonably would be expected to significantly impede, directly or indirectly, the conservation in the long-term of the species in the wild."[356] Unlike the current ESA's definition of "jeopardy," which appreciates both long-term and short-term risks of harm to species, the TESRA definition of jeopardy apparently tolerates short-term harms—an expense species on the brink of extinction cannot afford.

Further, and perhaps most alarmingly, the TESRA repeals critical habitat designation and protection.[357] No species can survive without its habitat, and by flouting the concept of critical habitat designations, the TESRA may doom many species to extinction.[358] Representative Pombo tries to soften this blow to species protection efforts in Section 9, which outlines

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[350] H.R. 3824, 109th Cong. (2005).

[351] Felicity Barringer, *House Votes for New Limits on Endangered Species Act*, N.Y. TIMES, Sept. 30, 2005, at A20.

[352] *See id.*

[353] Erik Stokstad, *What's Wrong With the Endangered Species Act?*, 309 SCIENCE 2150, 2151 (2005).

[354] H.R. 3824 § 3(a)(2)(A).

[355] *Id.* at § 3.

[356] *Id.*

[357] *Id.* at § 5.

[358] THREATENED AND ENDANGERED SPECIES RECOVERY ACT OF 2005: SECTION-BY-SECTION ANALYSIS 1–2 (2005), http://www.nesarc.org/HR3824sectionbysection.pdf (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review). While there has been continuous debate over the effectiveness of critical habitat designation in protecting endangered and threatened species, it is worth noting that "species with protected critical habitat are twice as likely to be recovering than species without it." JEREMY NICHOLS, IF IT AIN'T BROKE, DON'T FIX IT (2004), http://www.biodiversityassociates.org/wildspecies/news/n31aug04.html (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review).

Recovery Plans.[359] Under the TESRA, the Secretary is to develop and implement a recovery plan for each endangered or threatened species within two years of the species' listing.[360] These recovery plans are to be based on the best available science (as defined by the Secretary) and include "[a]n identification of those specific areas that are of special value to the conservation of the species."[361] However, unlike the current ESA's critical habitat provisions, these recovery plans are discretionary, non-binding, and would have no regulatory force.[362]

Section 9 further provides that if a listed species occupies more than one state, each state where the species is found "may pursue a determination that the portion of the species found in that State may be removed from [endangered and threatened species lists]."[363] Such a fragmented, piecemeal approach to species conservation—which would at least decentralize and at worst sabotage species protection efforts—has no place in any sincere conservation scheme.

The TESRA would further undermine species protection efforts by legislatively or practically precluding agency review. Section 12 of the TESRA legislatively exempts certain proposed federal actions from independent agency review.[364] Section 13 of the TESRA requires agency review of every "proposed use" requested by a private property owner.[365] If this review is not completed within 180 days, the use is deemed approved. Thus, TESRA section 13 exacerbates the ESA's burden on the already overworked, understaffed, and underfunded wildlife agencies. For all practical purposes, Section 13(d) of the TESRA would allow numerous environmentally unsound projects to proceed on private property.[366]

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[359] H.R. 3824 § 9.

[360] *Id.*

[361] *Id.*

[362] *Id.* ("Nothing in a recovery plan shall be construed to establish regulatory requirements or otherwise to have an effect other than as non-binding guidance."). *See also id.* (providing that the Secretary need not prepare a recovery plan if he "finds that such a plan will not promote the conservation and survival of the species"); Erica Werner, *U.S. House to Vote on Major Rewrite of Endangered Species Act*, Associated Press, Sept. 29, 2005, *available at* http://www.nrdc.org/news/newsDetails.asp?nID=1856 (noting that the TESRA's recovery plan provisions have no regulatory force).

[363] H.R. 3824 § 9.

[364] *Id.* § 12.

[365] *Id.* § 13.

[366] The TESRA also requires the federal government to compensate private parties whenever such parties propose to undertake an activity that would result in the taking of an endangered species.

> (d) Eligibility for Aid.—(1) The Secretary shall award to private property owners who (A) received a written determination under section 10(k) finding that the proposed use of private property would not comply with section 9(a); or (B) receive notice under section 10(k)(10) that a written determination has been withdrawn. (2) Aid shall be in an amount no less than the fair market value of the use that was proposed by the property owner if—(A) the owner has foregone the proposed use; (B) the owner has requested financial aid—(i) within 180 days of the Secretary's issuance of a written determination that the proposed use would not comply with

In sum, the TESRA represents "a deadly blow to the protections of the Endangered Species Act."[367] While the House's passage of TESRA is a cause for serious concern, there is still time for wildlife conservationists to sound the alarm and rally the public. The battle for the future of the ESA is far from over.

Some commentators have noted that "[i]f past history is any guide, . . . even a Republican-Party 'trifecta' . . . is no guarantee that any amendment of the ESA will ultimately be enacted."[368] Not even the TESRA's sponsor, Representative Pombo, expects the Senate to act quickly.[369] Further, while the Administration and some in Congress seem intent on chipping away at environmental protections, overall public support for the ESA remains strong.[370]

Whether politicians hoping to change the substantive mandate of the Act will face an onslaught of public criticism remains to be seen. The public outcry will likely be louder if the public is made fully aware of what a "sound science" amendment like the TESRA will really do; if it is made aware that "sound science" is something of a misnomer.

f. Why "Sound Science" Is Anything but Sound

By requiring that definitive scientific "proof" precede wildlife agency action, sound science initiatives will indefinitely stall the regulatory process.[371] In their eternal quest for the "one truth," sound science advocates con-

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> section 9(a); or (ii) within 180 days after the property owner is notified of a withdrawal under section 10(k)(10); and (C) the foregone use would have been lawful under State and local law and the property owner has demonstrated that the property owner has the means to undertake the proposed use.

Id. § 14.

[367] Barringer, *supra* note 351 (quoting Jamie Rappaport Clark, Executive Vice President of Defenders of Wildlife and former U.S. Fish & Wildlife Service (USFWS) Director under President Clinton).

[368] Brennan et al., *supra* note 6, at 438.

[369] *See* Barringer, *supra* note 351. *But see* The Wildlife Society, *ESA Debate Resumes*, 15 Wildlife Pol'y News 1, 4 (2005) (noting that Senate Wildlife Subcommittee Chairman Lincoln Chafee (R-R.I.) and several other Republican Congressmen announced their intention to update the ESA).

[370] "When citizens had the chance to vote directly on protecting natural resources . . . and other environmental matters, sizable majorities voted in favor of them," says Wilderness Society spokesman Ben Beach. Knickerbocker, *supra* note 309. The Administration has also weakened the 2001 Roadless Rule, which was founded upon decades of scientific research and over *two million* public comments. McDaniel, *supra* note 54, at 870.

[371] Wagner, *supra* note 8, at 229–30.

> [I]f scientifically sophisticated legislators wish to slow or halt environmental programs, they will simply ensure either that definitive scientific research is a prerequisite to regulatory action or that the agency's regulatory justifications be based on "sound science" or rigorous cost-benefit analysis. Because these scientific tools are incapable of providing such definitive answers, the regulatory process will be stalled, perhaps indefinitely.

tinually demand more time and better research. What they fail to acknowledge or admit is that there will *never be "enough" science*. By its very nature, science is never conclusory. Scientists make hypotheses and test them, trying to disprove them in numerous different ways. The more evidentiary support a hypothesis commands, the greater its general level of acceptance in the scientific community and eventually in the population at large. *But nothing in science is ever a "proven fact."* The only guaranteed outcome of perpetually waiting for more science is "paralysis by analysis."[372]

The Bush Administration as well as Congressional advocates of "sound science" in the endangered species context are taking advantage of the public's misperception that science can provide "the one answer" to any scientific question. By assuring the public that all we must do is wait for "sound science" to provide "complete knowledge," sound science pushers do nothing but put us on perpetual hold: a hold that can never—by the definition of what science is and all it can do—be broken.

Further, it is a hold that is neither necessary nor sufficient for truly "sound" resource management.[373] When species are on the brink of extinction, management decisions must be made immediately; time is a luxury imperiled species cannot afford.[374] And even given unlimited time, the complex, diverse, and dynamic nature of ecosystems does not lend itself to our full understanding.[375] Thus, "sound science" initiatives are inherently unsound. Given the time-sensitive nature of species conservation decisions, managers must be able to draw on what they *do* know to make an informed judgment; the judgment must be made now, and the judgment must be respected by lawmakers.[376]

B. Where We Should Go . . .

Rather than premising our ESA framework on the idea that more science is better science, we would be more effective in our conservation efforts by acknowledging the limitations of science and approaching the pol-

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Id.

[372] Doremus, *supra* note 62, at 415 (citing David C. Vladeck & Thomas O. McGarity, *Paralysis by Analysis: How Conservatives Plan to Kill Popular Regulation*, AM. PROSPECT, Summer 1995, at 78). Even science advisors under other Republican presidents have openly acknowledged that the search for one scientific truth in the environmental context is fruitless. Michael R. Deland, Chairman of the Council of Environmental Quality under Bush I, noted, "'[T]here is . . . seldom [a scientific consensus] on *any* environmental issue.'" Goodman, *supra* note 206, at 155 (emphasis added).

[373] Brunner & Clark, *supra* note 13, at 49.

[374] *Id.*

[375] *Id.*

[376] *See id.* at 49–50 (commenting that requiring "a better scientific foundation as a priority or a prerequisite . . . [is] neither necessary nor sufficient for [ecosystem] management decisions; and in any case, management decisions often cannot wait for them"). Given there will never be "enough" information, "[o]ur surest road forward . . . is to base . . . protections on what we do know." Babich, *supra* note 206, at 184 (referring to chemical pollutant risks).

icy sphere with a more holistic, interdisciplinary vision. A successful approach to species conservation will require us to change our habitual, piecemeal ways of thinking about the complex and dynamic realities of species protection issues and to create a new, flexible, and complete analytic framework through which to approach natural resource conservation challenges.[377]

Such change, of course, will not be easy. Given the ESA's remarkable successes[378] and its symbolic importance to the environmental movement, many people are resistant to a new approach to endangered species conservation. This wariness is understandable, especially in light of the current political climate and the recent rash of "sound science" initiatives. But more than anything else, the repeated attempts to chip away at the original Act only demonstrate how urgently we need to effect real, beneficial change. Our landmark species protection system is under attack. Rather than remaining on the defensive, conservationists must admit the limitations of the current system and commit to finding new and improved approaches to this complex social and scientific issue.

1. Choosing a Methodological Camp

The first step in crafting a new and improved approach requires choosing the process that will best enable us to conserve species richness and biodiversity in a socially agreeable manner. Describing the contours of such a process is challenging, and will require resource managers to think outside the box. As has been noted, "[a] good process will not happen on its own, nor will it come about by recycling standard operating procedures, bureaucratic arrangements, existing conflict, and old ideas."[379] Florida State University law professor J. B. Ruhl identifies three primary competing methodologies, each of which could possibly be used in a new ESA. Each method takes an entirely different approach to managing the risk of spe-

[377] *See* Clark, *supra* note 9, at 52 (noting that "[t]he first requirement of interdisciplinary problem solving is possession of a framework that can accommodate, conceptually and practically, diverse data, paradigms, and disciplines," and that the realities of species conservation issues "are dynamic and complex, and do not lend themselves to understanding or resolution using conventional, rigid or incomplete analytic frameworks"). *See also* Muchnick, *supra* note 92, at 110 ("Because recovery is a multifaceted task with both technical and social dimensions, the major constraint in [the current decision-making regime] is lack of effective processes to integrate science and values and to address—simultaneously and explicitly—the socioeconomic, political, and organizational dimensions of the task.").

[378] "[T]he Endangered Species Act has had an amazing rate of success in preventing species from going extinct. . . . We have hundreds of species [such as the whooping crane, bald eagle, and black-footed ferret] that would not be around today if not for the Endangered Species Act," notes John Kostyack, senior counsel for the National Wildlife Federation. Staff & Wire Reports, *supra* note 2. *See also* Timothy D. Male & Michael J. Bean, *Measuring Progress in US Endangered Species Conservation*, 8 ECOLOGY LETTERS 986 (2005) (presenting an analysis of species recovery under the ESA and finding that 52% of listed species' populations were stable or increasing).

[379] Clark, *supra* note 3, at 22.

cies conservation, and each has its pros and cons.[380] These three methods include the Scientific Method, the Precautionary Principle Method, and the Professional Judgment Method.[381]

a. Methodological Camp #1: The Scientific Method[382]

All else equal, most people would agree that the Scientific Method represents the preferred means of arriving at scientific conclusions.[383] Of the three methodologies, the Scientific Method—with its rigorous empirical testing requirements—enables a scientist to be most confident that his decision is "correct."[384] Reaching this level of certainty, however, is "the scientific equivalent of nirvana."[385] It is "a state rarely achieved even in well-funded research institutions," let alone in the field.[386]

In statistical terms, the Scientific Method is designed to reduce what is known as Type I error, which occurs when a scientist identifies a causal relationship that does not really exist (i.e., a "false alarm").[387] In the ESA context, a Type I error results in unjustified protection for a species.[388] Because the scientific method reduces opportunities for protection in this way, this methodology (often in the form of "sound science" initiatives) is frequently advanced by non-conservation-oriented interest groups.[389]

Requiring "sound science" for all ESA decisions will undermine species protection efforts because wildlife agencies will rarely be able to engage in the rigorous procedures demanded by the Scientific Method.[390]

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[380] Ruhl, *supra* note 6, at 556.

[381] *Id.*

[382] In his article Professor Ruhl refers to the "familiar Scientific Method, which is defined by the use of empirical observation and experimental testing to formulate and evaluate hypotheses, usually about causal mechanisms, with which to predict phenomena." *Id.* at 564. He refers to a concise summary of the Scientific Method provided by Professor Doremus:

> [The Scientific Method's] essential steps are observation, communication, informed criticism, and response. A scientist gathers data through observation or experimental manipulation. She then communicates those data, together with an explanation of methods used to gather them, to the community of scientists in her field. The scientific community reviews and critiques the work, commenting in ways that may inspire the original scientist and others to seek additional data or alternative explanations.

Id. at n.16 (quoting Doremus, *supra* note 12, at 1057).

[383] Ruhl, *supra* note 6, at 564–65. *See also* discussion of the scientific method *infra* Parts II.B.1, II.C.

[384] Ruhl, *supra* note 6, at 559.

[385] *Id.* at 565.

[386] *Id.* Even if it were scientifically possible to achieve this level of confidence, agencies do not have the "time, money, or clear mandate" with which to do so. *Id.*

[387] *Id.* at 559–60; DEBORAH RUMSEY, STATISTICS FOR DUMMIES 227 (2003) (calling a Type I error a "false alarm").

[388] Ruhl, *supra* note 6, at 561.

[389] *Id.* at 562.

[390] *Id.*

Requiring the Scientific Method to be applied in the ESA context "would strangle [the Act] to death."[391] Furthermore, a pure application of the Scientific Method does not admit policy considerations in any circumstances.[392] Given that public policy issues are unavoidable in the environmental arena, and given that the Scientific Method erects a nearly insurmountable procedural barrier to species conservation efforts, the Scientific Method is inapt as the exclusive ESA methodology.

b. Methodological Camp #2: The Precautionary Principle Method

The Precautionary Principle, supported by many environmental groups,[393] calls on wildlife agencies to exercise caution and err on the side of the species in the face of uncertain science.[394] The Precautionary Principle (i.e., the "better safe than sorry" method)[395] is most appropriate in situations where the consequences of a misstep are severe enough to be unacceptable.[396] In statistical terms, the Precautionary Principle guards against Type II errors, which occur if a scientist finds no causal relationship when in fact one does exist (i.e., a "missed detection").[397] In the ESA context, a Type II error would result in underprotection—and perhaps extinction—of a species.[398]

While it has emerged as the norm in international environmental law,[399] it is unlikely that either Congress or the wildlife agencies would grant the Precautionary Principle imprimatur in the ESA context.[400] Extreme precau-

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391 *Id.* at 590.

392 *Id.* at 599.

393 It is important to note that while the precautionary principle has become associated with the environmental movement, the principle is not normative by nature. *Id.* at 569. Environmentalists' preference for the precautionary principle in the ESA context is a function of how Congress phrased the agencies' decision hypothesis (i.e., that the agencies cannot regulate unless they establish a relationship between the potentially regulated activity and harm to a species of concern). *Id.*

394 *Id.* at 559, 561. "Under this method, all close calls are resolved in favor of extending protection to a species, even when the evidence in support of protecting a species is slim, sufficient at most to support a fear that failure to protect the species could have adverse consequences." *Id.* at 561.

395 Adelman, *supra* note 30, at 543. *See also id.* at 541–63 (discussing the Precautionary Principle and its interaction with statistics).

396 Ruhl, *supra* note 6, at 559.

397 *Id.* at 560; Rumsey, *supra* note 387, at 228 (calling a Type II error a "missed detection").

398 Ruhl, *supra* note 6, at 561.

399 Tarlock, *supra* note 14, at 141. Under international law, where there is evidence of significant environmental risk, the precautionary principle holds that the state has the power—if not the duty—to prevent future environmental harm. Tarlock, *supra* note 14, at 141. *See, e.g.*, Rio Declaration on Environment and Development Principle 15, June 14, 1992, 31 I.L.M. 874 ("In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.").

400 *See* Ruhl, *supra* note 6, at 562. *But see* U.S. Fish & Wildlife Serv. & Nat'l Ma-

tion could "wreak economic havoc . . . [and] severely reduce the [ESA]'s legitimacy from its already tenuous status."[401] Unlike the Scientific Method, which eschews conservation policy considerations, the Precautionary Principle embraces conservation values. At its core, the Precautionary Principle is more of a policy principle than a scientific process.[402] Because simple value choices provide an inadequate foundation for effective species conservation (in large part because they will not be politically palatable),[403] the Precautionary Principle alone is ill-suited to resolving ESA controversies.

c. Methodological Camp #3: The Professional Judgment Method

The Professional Judgment Method is the default rule for the 1973 ESA. It is supported by the Act's statutory text, administrative law, and the agencies themselves.[404] This method allows agencies to act when the Scientific Method is impractical, unethical, too time-consuming, or too costly by permitting experienced agency scientists to fill the gaps in our current knowledge base.[405] The Professional Judgment Method rests on "considered, well-reasoned, deliberative decision[-making] supported by the professional experience, learning, practice, and expertise relevant to the subject matter of the agency's decision."[406]

The Professional Judgment Method does not concern itself with avoiding either Type I or Type II errors *per se*, but rather places its confidence in the ability of wildlife agency experts to weigh the evidence and arrive at reasonable conclusions.[407] Adhering to the Professional Judgment Method allows the wildlife agencies to strike a balance between adequate science and species protection.[408] Further, the Professional Judgment Method accords with the courts' interpretation of ESA's best available science require-

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rine Fisheries Serv., Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act 1–6 (1998), *available at* http://endangered.fws.gov/consultations/s7hndbk/s7hndbk.htm ("Where significant data gaps exist . . . [the Services may] develop the biological opinion with the available information giving the benefit of the doubt to the species."); Ruhl, *supra* note 6, at 594 n.164 ("Notably, [aside from the conference report to the 1979 amendments to the Section 7 jeopardy consultation provision,] I have found no other reference to the 'benefit of the doubt' principle in any legislative history of the ESA or its amendments.").

[401] Ruhl, *supra* note 6, at 562.

[402] NRC Final Report, *supra* note 142, at 315.

[403] I.e., because application of good science is also requisite.

[404] Ruhl, *supra* note 6, at 556, 560.

[405] *Id.* at 559. It further enables the agencies to make decisions within the statutory time frame. *Id.* at 577.

[406] *Id.* at 566.

[407] *Id.* at 561. Indeed, the Professional Judgment Method appears to be entirely indifferent to both science and precaution. *Id.* at 583. The wildlife agencies are presumed to be "repositories of professional expertise." *Id.* at 578.

[408] *Id.* at 561.

ments, and trusts that judicial review will smoke out unjustified agency decisions.[409]

The courts' approach to the best available science mandate in the context of critical habitat designations generally supports the use of the Professional Judgment Model. In fact, in the critical habitat context, at least one court has rejected use of both the Precautionary Principle and the Scientific Method.[410] In *Home Builders Ass'n of N. Cal. v. United States Fish & Wildlife Serv.*, the court first held that a wildlife agency may not designate as critical habitat areas that are not affirmatively found to contain those biological, physical, and other elements essential for the conservation of a species.[411] In other words, it cannot take a precautionary approach at the outset on the grounds that it can later remove non-essential lands as more data become available.[412] Likewise, the court rejected strict application of the Scientific Method by holding that even in the face of limited scientific data, as long as a wildlife agency is forthright in acknowledging the uncertainty and adequately explains why it designated an area as critical habitat, the court will generally defer to the agency's decision.[413]

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[409] *Id.* at 565 (under, e.g., the "arbitrary and capricious" and "substantial evidence" standards of judicial review). Courts are relatively deferential to agency decisions because they do not have the technical training that would enable them to independently evaluate scientific determinations. *Id.* at 578; Doremus, *supra* note 62, at 412. The Supreme Court has held that when it comes to interpreting scientific information, "[w]hen specialists express conflicting views, an agency must have discretion to rely on the reasonable opinions of its own qualified experts even if, as an original matter, a court might find contrary views more persuasive." Marsh v. Or. Nat'l Res. Council, 490 U.S. 360, 378 (1989). Judicial review of ESA decisions thus proceeds under the "arbitrary and capricious" standard of the Administrative Procedure Act. 5 U.S.C. § 706 (2005). The Supreme Court noted that an agency's decision is suspect if it

> has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise,

or if it has failed to "articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" Motor Vehicles Mfrs. Ass'n v. State Farm Mut., 463 U.S. 29, 43 (1983) (citations omitted). For a comprehensive discussion of the relationship between the ESA's "best scientific data available" standard and judicial review, see *generally* Brennan et al., *supra* note 6.

[410] *See* Home Builders Ass'n of N. Cal. v. United States Fish & Wildlife Serv., 268 F. Supp. 2d 1197 (E.D. Cal. 2003).

[411] *Id.* at 1210 ("[L]ands designated as critical habitat *must*, under the ESA, contain physical and biological features essential to the conservation of the species.") (emphasis added).

[412] Ruhl, *supra* note 6, at 583 (summarizing the Court's decision in *Home Builders Ass'n of N. Cal.*, 268 F. Supp. 2d at 1210).

[413] *See Home Builders Ass'n of N. Cal.*, 268 F. Supp. 2d at 1221 ("[W]hile Defendants are correct in arguing that uncertainty as to exactly where [an endangered species] may be found does not mean that a designated area is not critical habitat, at some point such *uncertainty makes it an abuse of discretion for the Service to designate the land as occupied under section 1532(5)(A)(i).*") (emphasis added). *See also* Ruhl, *supra* note 6, at 583–84 (describing the methodological standards the wildlife agencies must satisfy when designating critical habitat). "Even where there are competing expert opinions, or where the sci-

What we are left with, given the courts' approach to listing and critical habitat determinations, is a best science available standard that accords quite well with the Professional Judgment approach.

d. The Best of All Worlds

While the Professional Judgment Method appears to be the overall best fit within our current ESA framework, the other two methods should not be entirely discounted. Professor Ruhl presents natural resource managers with the challenge of "establishing a framework with the Professional Judgment Method at its core, but with the Scientific Method and Precautionary Principle Method in play."[414] If we are successful in this endeavor, we can avoid both unnecessary socioeconomic costs and unnecessary species extinctions.[415]

Under Professor Ruhl's proposal, the Professional Judgment Method would be the "workhorse" of wildlife agencies' ESA decisions, with the courts' and agencies' interpretations of the best available science mandate spelling out how the agencies' judgment should be exercised.[416] The Precautionary Principle would be a tool wildlife agencies could use in those infrequent cases where "a) the evidence is inconclusive or even points against taking protective measures, but for which b) there is sufficient cause to believe that a decision not to take protective measures could be wrong and, if so, the consequences thereof could place the species on an irreversible path towards extinction."[417] To ensure that the Precautionary Principle is not invoked indiscriminately, the Scientific Method could be used as a check.[418] Decisions made under the Precautionary Principle would be

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entific data are equivocal, it is the agency's prerogative 'to weigh those opinions and make a policy judgment based on the scientific data.'" *Id.* at 579 n.79 (citing Maine v. Norton, 257 F. Supp. 2d 357, 389 (D. Me. 2003) (quoting Brower v. Daley, 93 F. Supp. 2d 1071, 1082–83 (N.D. Cal. 2000))).

[414] Ruhl, *supra* note 6, at 599.

[415] *Id.*

[416] *Id.* at 600.

[417] *Id.* The delisting of the grizzly bear (*Ursus arctos horribilis*) is one example of such a case. After being listed as threatened in 1975, the Greater Yellowstone grizzly population increased from 200 to around 600 animals. Mike Stuckey, *Uproar Over Plan To Delist Yellowstone Grizzlies*, Aug. 18, 2005, http://www.msnbc.msn.com/id/8971332 (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review). Thus, some people think the bear no longer needs the ESA's protections to survive. Others disagree, arguing that the bears' low reproductive rate, large home range, chronically high human-caused mortality rates, and sensitivity to habitat loss mean that delisting will lead to extinction of the bear in the Greater Yellowstone Ecosystem. *See* Louisa Wilcox & David Ellenberger, Sierra Club Grizzly Bear Ecosystems Project—The Bear Essentials for Recovery: An Alternative Strategy for Long-Term Restoration of Yellowstone's Great Bear 4 (2000), *available at* http://www.sierraclub.org/grizzly/reports.asp. There is data to back up both sides' contentions. Given the repercussions of a misstep in this case (i.e., extinction of a species whose recovery is otherwise an ESA success story) use of the Precautionary Approach may be warranted while the science is reviewed and database enhanced.

[418] Ruhl, *supra* note 6, at 600.

subject to rigorous, independent peer review to ensure that the decision was not too far out of line with the best available science.[419]

2. Recognizing the Public

Determining what methodology is most appropriate for endangered species conservation is only one decision that must be made as we move toward a more effective, sustainable conservation framework. Another important determination requires consideration of what role the public should play in species conservation decisions.

Ecosystem and species conservation inherently rest upon how the public values various natural resources.[420] How much society values species survival as compared to how much it values other goods, such as cheap gasoline or new housing developments, will affect the success of our conservation efforts. This value-laden human dimension to species conservation is too often overlooked in natural resource management decisions. Ignoring the human element of species conservation decisions creates societal discord, jeopardizes our current species protection efforts, and hinders our ability to find permanent solutions to conservation-related problems.[421] These environmental problems can be solved only once the whole context—including the human element—is understood, appreciated, and incorporated into the decision-making framework.[422]

To remedy this problem, some commentators have pushed for an increased public role in resource management decisions.[423] They believe it is "unrealistic and self-defeating" to pretend that natural resource conflicts can be resolved behind closed doors, whether by scientific experts or public policy makers.[424] Effective public oversight and actual public involvement, they believe, could foster democratic legitimacy and thus enhance scientific credibility.[425]

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[419] *Id.* at 600–01. If the peer review determined that the agency's decision was out of step with the best available science, the agency could either revise its decision, or proceed at its peril (i.e., subject to traditional judicial review). *Id.* at 601. The peer review would offer agencies a "safe harbor" if their decision comported with the reviewers' assessment. *Id.* at 602. The peer review would likewise provide challengers with ammunition if the agency's decision was out of step with the reviewers' assessment and the agency did not revise its decision accordingly. *Id.* Under Professor Ruhl's proposed model, if a federal, state, local, tribal, or private entity wanted to challenge an agency decision, it would file a petition for review. *Id.* The petition would be reviewed by a standing panel of National Research Council (NRC) scientists to determine whether it warranted further action. *Id.*

[420] Clark, *supra* note 3, at 22.

[421] *Id.* at 26.

[422] Clark, *supra* note 9, at 37.

[423] *See, e.g.*, Doremus, *supra* note 12, at 1036; Goodman, *supra* note 206, at 136 ("Government agencies should respect the principle that regulatory policies affecting the public should not be made behind closed doors.").

[424] Goodman, *supra* note 206, at 157; Doremus, *supra* note 12, at 1148, 1151.

[425] Doremus, *supra* note 12, at 1036. Legitimacy would be enhanced, in part, by involving the wildlife agencies' "customers"—i.e., the public—in the decision-making proc-

Mediation, facilitation, problem solving, and other such methods have all been suggested as ways to promote actual public involvement.[426] These techniques provide interested parties across the disciplinary and interest-group spectrum the opportunity to participate in the decision-making process.[427] Presumably, use of these methods would allow the perspectives and values of all stakeholders to be taken into account as a solution is devised. Participants would come to see themselves as a "part of an ongoing and educable process of problem identification and definition, debate, decision, and program implementation and evaluation," and would be more supportive of the group's ultimate consensus.[428] Such a democratic approach could increase the legitimacy of species protection processes in the eyes of the public and more effectively allow the goal of species conservation to be realized.[429]

a. Public Participation Proposal #1

One proposal for public involvement comes from Professor Tim W. Clark of the Yale School of Forestry and Environmental Science. Professor Clark has noted that "[b]ecause the outcome [of an endangered species decision] determines what happens to a public resource, the management process is—or should be—open and public."[430] He suggests a rational, integrative, and comprehensive decision-making process that involves the

ess. Goodman, *supra* note 206, at 143. Clark, *supra* note 3, at 26. *See also* Boersma et al., *supra* note 104, at 648 ("[T]he newly promulgated policy endorsing diversification of participants in recovery plan development should be vigorously pursued."); Muchnick, *supra* note 92, at 114.

[426] *Policy-Oriented Curricula*, *supra* note 8, at 35.

[427] ADLER ET AL., *supra* note 35 (describing the use of, and stakeholder involvement in, alternative resolution methods in the environmental context).

[428] Muchnick, *supra* note 92, at 113.

[429] Public involvement enhances legitimacy insofar as it provides an opportunity for people to invest themselves in the species protection process and outcome. People are more likely to support a decision that they feel was made by a fair process, even if they don't agree with every detail of the final rule. According to Jeff Eisenberg of the National Cattlemen's Beef Association, "'[F]or conservation to succeed and be effective, you need to win the hearts and minds of the people who live on the land.'" Felicity Barringer, *U.S. Plan May Keep Sage Grouse Off Endangered List*, N.Y. TIMES, Nov. 10, 2004, at A21. Ensuring that those affected are involved in the decision-making process is one way to win those people's support. For a general discussion on the importance of democratic deliberation in the environmental legislation context, see Wagner, *supra* note 8, at 263–66; Clark, *supra* note 3, at 23 (promoting a decision-making framework that "reveals options for action to people with authority or those with the desire and ability to make a difference"); Clark, *supra* note 9, at 46 ("[If] planning, debating, and rulemaking phases are not inclusive, open, reliable, and comprehensive, then it is likely that implementation will be weak, lawsuits will proliferate, and the effort will go on with little consensus or resolution.").

[430] Clark, *supra* note 3, at 22. "Decision making should be open and accessible to those with something to contribute or something at stake. . . . '[S]elective omission' often serves personal or special interests and causes unproductive conflict." *Id. See also* Muchnick, *supra* note 92, at 107–08 (stating that participants in wolf management roundtable did not include all relevant stakeholders, but were rather hand-picked by state authorities).

systematic gathering, disseminating, and processing of information.[431] Under Professor Clark's model, decision-makers should accumulate species and ecosystem data, information on people's values and beliefs, and descriptions of organizational behavior and institutional practices.[432] After this information is gathered and disseminated to the public, there should be open and public debate about the information gathered.[433] After further consideration of the information gathered and reflection on the public debate, an ultimate decision is made.[434] This process should proceed as quickly as possible, since lag time can be fatal in the endangered species context.[435] Once the decision is made and the conservation program implemented, continuing evaluation is necessary to assess the program's effectiveness and to allow necessary "corrections" to be made.[436]

I agree with Professor Clark's approach to data accumulation, public debate, and adaptive management. Information on affected species and ecosystems, on affected people's values and beliefs, and on institutional practice are all needed before an effective conservation scheme can be developed. Acknowledging that values other than conservation are deserving of respect can go a long way toward the ultimate success of an endangered species program.[437] Insofar as our current ESA forbids real consideration of and respect for these factors, I believe it should be amended.

However, I am uncertain just how much influence Professor Clark believes the public should have on species-specific "to conserve or not to conserve" decisions. While I firmly believe that public concerns should be taken into consideration in the development of the particulars of a species conservation *program*, I do not believe that the public should have the final say as to whether a *particular species* is "endangered enough" or "important enough" to be protected. That brings me to a second public involvement proposal.

[431] Clark, *supra* note 3, at 22, 23.

[432] *Id.* at 22. Fully exploring a conservation-related problem involves defining biological and social goals; identifying historical trends that have led to the current situation; examining conditions that have created the trends; projecting what will happen in the future based on past trends; and developing alternatives which may lead us to ends more consistent with our biological and social goals. *Id.* at 23–25.

[433] *Id.* at 22.

[434] *Id.*

[435] *Id.* Legal challenges under the current system often frustrate timeliness of decision-making. Fixing this flaw should be a primary goal of any amendment efforts.

[436] *Id.*

[437] For example, in the wolf reintroduction context, Defenders of Wildlife offered to pay ranchers for livestock killed by wolves. I do not suggest that monetary payout is the appropriate response to all conservation problems. I use it only as an example of a situation where diametrically opposed stakeholders were able to come to some sort of resolution—that ultimately worked to benefit the wolf—because they were involved in an open and public discourse and respected each others' values.

b. Public Participation Proposal #2

This public participation proposal—which more directly addresses the public's ability to decide whether a species is deserving of protection—comes from Professor Holly Doremus.[438] According to Professor Doremus, the first step in an effective ESA program involves separating scientific data interpretation from policy judgments.[439] This makes much sense, as conflating the two would serve only to complicate matters and delegitimize science. Professor Doremus would then entrust the non-scientific elements of a listing determination to the public through an open political process that would take into account all relevant viewpoints.[440]

While this approach is attractive from a democratic standpoint, I disagree with it insofar as it would give the public the final say in any given endangered species listing decision. While I wholeheartedly agree with allowing the public to participate in the formulation of alternative, agreeable endangered species management plans, I am not convinced that allowing the public to finally decide whether to protect each *individual* species would help us achieve true species protection (assuming the Nation remains committed to such conservation). I worry that allowing the public to determine whether it thinks each particular species is "important" would result in protection of only the "charismatic megafauna."

Professor Doremus addresses this concern by arguing that the public forum would provide scientists with the opportunity "to educate the public concerning the range of benefits provided by species."[441] However, her proposal "rests on the presumption that the average citizen can be sufficiently educated on technical issues to play an informed role in the policy process."[442] Given the lack of scientific knowledge that characterizes American society today, I have less faith that a town meeting or two will convince the public of the intrinsic worth of the Furbish lousewort (*Pedicularis furbishiae*) or the false water rat (*Xeromys myoides*). Public education is a laudable goal in and of itself, and it is crucial to the ultimate success of our conservation programs. Perhaps in the future the public will be well-enough versed in the relevant science to play a more informed role in listing determinations. However, at this juncture, experts are better-equipped to formulate sound wildlife policy than the general public.

Given a different America, an America that educates its children about the importance of ecological integrity from the outset, the public decision-making model could be quite effective. But given the scientific illiteracy characterizing America today, opening listing decisions up to the

[438] *See* Doremus, *supra* note 12, at 1129–50.
[439] *Id.* at 1130.
[440] *Id.* at 1130–31.
[441] *Id.* at 1131.
[442] Noah, *supra* note 21, at 1043 (citing SHEILA JASANOFF, THE FIFTH BRANCH: SCIENCE ADVISERS AS POLICYMAKERS 32–34 (1990)).

whim of the public will only undercut real species protection.[443] From a scientific standpoint this kind of capricious decision-making is untenable; we cannot protect an area's top predators or other warm and fuzzy critters while simultaneously knocking out the nuts and bolts of a system's foundational trophic levels. Furthermore, even if some species could be selectively stamped out without wreaking havoc on ecosystem function, our scientific understanding is nowhere near sophisticated enough to make those kinds of determinations. Again, I am not saying that the public voice should not be heard, but only that it should not be the ultimate determining factor of an individual species' worth. Because of their specialized training, biologists and other conservation scientists have the best understanding of how a species—even an "ugly" or "undesirable" species—may be important to an ecosystem.[444] Thus, in my opinion and as long as we as a Nation remain committed to species protection, wildlife agencies staffed with knowledgeable scientists should retain their expert authority to determine whether a particular species deserves the protections of listing.

Professor Doremus addresses these concerns in several ways. First, she asserts that species protection imposes costs on society, and that proponents of species protection must justify why the benefits of protection exceed the costs.[445] While this is true, I do not believe this needs to be done on a species-by-species basis. In enacting the ESA, America has already *made* the ultimate decision that species are worth protecting regardless of the cost.[446] Congress made this clear by requiring that listing determinations be made "solely on the basis of the best scientific . . . data avail-

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[443] The ESA aims to protect the "esthetic, ecological, educational, historical, recreational, and scientific value" of disappearing species. 16 U.S.C. § 1531(a)(3) (2005). *See also* Doremus, *supra* note 12, at 1131–32.

[444] *See* Tarlock, *supra* note 14, at 138–39 (noting that while the argument for subordinating science to democratic decisions is powerful, "it fails to appreciate the central role that science must play in the formulation of public policy when the issues have a substantial technical or empirical component"). *See generally* Bo Ebenman et al., *Community Viability Analysis: The Response of Ecological Communities to Species Loss*, 85 Ecology 2591 (2004). Ebenman et al. describe how "[t]he loss of a species from an ecological community can set up a cascade of secondary extinctions that in the worst case could lead to the collapse of the community," and that the risk of collapse was greatest "when a basal species was deleted and lowest when a top species was removed." *Id.* at 2591, 2597. This is cause for concern because it is the top species, rather than basal species, which elicit more sympathetic responses from the public at large.

[445] Doremus, *supra* note 12, at 1140.

[446] *See* Brennan et al., *supra* note 6, at 429 (citing H.R. Rep. No. 95-1625, at 13 (1978), *reprinted in* 1978 U.S.C.C.A.N. 9453, 9463) ("[I]ndividuals charged with the administration of the [ESA] do not have the legal authority to weigh the political importance of an endangered species."). *See also* Ruggiero, *supra* note 26, at 76:

> In the United States, . . . natural resource management laws . . . are drafted by elected officials, ratified by elected officials, and implemented by political appointees [and] ostensibly represent the guidelines for the way in which people desire that natural resources be managed. When we manage in accordance with these laws, we are, by definition, managing for the desires of people.

able" and irrespective of economic costs.[447] The Supreme Court in *Tennessee Valley Authority v. Hill*[448] made this clear in interpreting the ESA as representing our commitment to "halt and reverse the trend toward species extinction, whatever the cost."[449] Unless and until America abandons its commitment to species protection, economic costs should not be factored into the determination of whether a species is imperiled enough to be listed. If scientists' best judgment indicates that a species is at risk, the burden should not be on proponents of protection to ensure that the species receives the protection it deserves; the scientists' determination should hold sway.

Secondly, Professor Doremus says that long-term political support is necessary for the continued viability of the ESA.[450] This is undeniably true. It was support for species protection that led America to enact the ESA in the first place, and its continued viability depends on Americans' continued valuation of species survival. However, Professor Doremus asserts that by denying protection to "truly unloved subspecies or populations, [we] would trade short-term pain for long-term political gain."[451] I suppose my aversion to such a scheme stems from the fact that it allows the public, in a very real sense, to play God.[452] As Aldo Leopold wisely observed, "To keep every cog and wheel is the first precaution of intelligent tinkering."[453] If we are really committed to protecting species, and if we trust

[447] 16 U.S.C. § 1533(b)(1)(A) (2005). Congress's intent to exclude economic considerations from listing determinations is evident from the legislative history of the 1982 Amendments: "The Committee strongly believes that economic considerations have no relevance to determinations regarding the status of species . . . Applying economic criteria to the analysis [involved in] any phase of the species listing process is applying economics to the determinations made under Section 4 of the Act and is specifically rejected by the inclusion of the word 'solely' in this legislation." Brennan et al., *supra* note 6, at 396 n.39 (citing H.R. REP. NO. 567, pt. 1, at 20 (1982), *reprinted in* 1982 U.S.C.C.A.N. 2807, 2820). Compare agency considerations for critical habitat designations, which expressly require consideration of economic and other relevant impacts. 16 U.S.C. § 1533(b)(2).

[448] 437 U.S. 153 (1978).

[449] *Id.* at 184. Chief Justice Burger, in writing the majority opinion for Tennessee Valley Authority v. Hill, discussed the values of species' contributions to biodiversity and to human societies. *Id.* at 178–79. *See also* Brennan et al., *supra* note 6, at 389 ("[T]he Endangered Species Act of 1973 . . . stands out among its contemporaries not only for its comprehensiveness, but also for its extreme dedication to endangered and threatened species conservation, to the exclusion of virtually every other interest, including economic considerations.").

[450] Doremus, *supra* note 12, at 1140–41.

[451] *Id.* at 1141.

[452] Houck, *supra* note 2, at 416 ("Who would play God . . . . [T]he questions are too difficult to answer."). Allowing the public to play God is particularly troubling in the environmental context, where the public's scientific illiteracy means that it is ill-equipped to consider ecological benefits. "Judgment in environmental policy . . . is complicated by the inadequacy of rigid quantitative cost-benefit analysis, which omits many kinds of important values, not least the value of difficult-to-quantify ecological processes." Wiener, *supra* note 290, at 355–56. Until we develop "[a] more complex and embracing form of benefit-cost judgment, which includes consideration of qualitative factors, ecological risks and values, and uncertainties," and until we teach the public to properly use such a tool, people should not be able to play God by determining which species live and which die. *Id.* at 356.

[453] ALDO LEOPOLD, ROUND RIVER 147 (Luna B. Leopold ed., 1953).

in ecosystem science enough to know that even the most unassuming species plays a role,[454] denying protection to "truly unloved" species undermines our total commitment to species conservation. Allowing—indeed endorsing—decisions based on such ignorance and misunderstanding is misguided and contrary to the spirit of the ESA.

Professor Doremus argues further that this new scheme would not necessarily lead to less protection for less appealing species.[455] This is true; such a scheme will not *necessarily* lead to less protection. It cannot be predicted with any certainty just what effects the implementation of such a new scheme might bring. Professor Doremus suggests that perhaps the public would provide *more* support for undesirable species than the agencies now anticipate.[456] In that case, wildlife agencies would protect more species than they would otherwise. This is a possibility. However, to me it seems more plausible that increased public input and political pressure, combined with the wildlife agencies' short-staffing and under-funding problems, would lead to protection of even fewer species.[457]

At the end of the day, the question we must ask ourselves is, "Is it worth it?" Is it worth undermining our scheme of species protection which, while imperfect, has been quite successful overall? And yes, this involves a risk assessment and a value choice. But I believe that American society has consciously made the initial choice to "halt and reverse the trend towards species extinction, whatever the cost." I also believe that public support for species protection remains strong.[458] Retaining that strong support base requires that we allow the public to be more involved in the species protection process. It requires that we find ways for the public to participate in the formulation of various workable management alternatives. It does not, however, require that the public decide whether a species is scientifically deserving of protection in the first instance (i.e., the listing determination). That inquiry and decision should properly be left to the wildlife agencies and conservation scientists, whose specialized training and experience provides them with the expertise necessary to make such difficult determinations.

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[454] *See* Adler et al., *supra* note 35, at 16 ("Reductionism—seeking to understand the system by looking only at the units and their relations with one another—is prone to inducing error.").

[455] Doremus, *supra* note 12, at 1141.

[456] *Id.*

[457] The history of the Act confirms this suspicion: even with the best available science mandate firmly intact, "scientifically deserving but uncharismatic species" are not garnering ESA protection. Doremus, *supra* note 62, at 427 (citing U.S. General Accounting Office, Endangered Species: A Controversial Issue Needing Resolution (1979)).

[458] *See, e.g.*, The Wildlife Society, Wildlife Policy Statement: Threatened and Endangered Species, http://www.wildlife.org/policy/index.cfm?tname=policystatements&statement=ps13 (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review) ("Public support for financing threatened and endangered species has increased over the last few decades.").

3. Thinking Outside the Box

A democratic, public participation model largely uninformed by science is not a viable means of protecting species in the long run: "Once the science-decision nexus is ruptured, the more difficult it is to reach a consensus among shareholders."[459] Despite the fact that science is not a panacea for all our environmental woes, scientists have repeatedly demonstrated science's ability to identify, explain, and remedy environmental problems.[460] Abdicating science in the ESA context is equivalent to abandoning our commitment to species protection. But that does not mean we should continue to apply the rigid, piecemeal approach to species protection that flows from our current ESA. The public should play a more active role in the management planning process. Developing and implementing decision-making models that allow us to view environmental problems through an ecosystem-based, participatory, interdisciplinary lens would allow us to make more holistic, supportable, flexible, and sustainable decisions.

a. Toward an Interdisciplinary Approach

Creation and implementation of a truly ecosystem-based, problem-oriented approach to endangered species protection will require the participation of not just wildlife agency scientists (who will continue to play a key role) but also individuals across the disciplinary spectrum, as well as the general public. Bringing professionals from numerous disciplines into the conservation arena will allow natural resource professionals to understand how different values interact in the policy-making arena[461] and thus equip them with the tools they need to effectively advocate species conservation in our pluralistic society.[462] Such a pluralistic view is notably lacking in current conservation efforts, and this deficiency "is proving a hindrance to our ability to conserve the biodiversity of the Earth."[463]

Under the current conservation paradigm, when stakeholders "are thrown together to address a [species conservation related] problem[, they] often use divergent forms of reasoning, subscribe to different ideologies, and seek diverse goals."[464] Conflict inevitably ensues, and we continue to "muddle[ ] through one crisis after another without truly understanding the

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[459] Tarlock, *supra* note 14, at 144.

[460] *Id.* at 143. The demonstrated powers of science place a "substantial burden on those who seek to displace or pervert it." *Id.*

[461] At least until individual natural resources professionals can themselves become versed in a variety of disciplines, it is imperative that scientists from across disciplines become involved in any environmental dispute resolution process. ADLER ET AL., *supra* note 35, at 23 (it is important to "[i]nsure that a mixture of types of scientists appropriate to the case is involved in any given resolution process").

[462] *Policy-Oriented Curricula*, *supra* note 8, at 32 (citing K. L. Jope, *Paradigm of Species Conservation*, 8 CONSERVATION BIOLOGY 924, 925 (1994)).

[463] *Id.*

[464] *Leadership*, *supra* note 8, at 10.

nature of the problems, solving them, or gaining insight into why the process is not effective."[465] Our traditional problem-solving approach is characterized by "interdisciplinary slippage," where communication is stifled and cooperative problem solving becomes a near-impossibility.[466] Because species conservation problems are inherently multidisciplinary and anything but susceptible to traditional problem solving, disciplinary integration and creativity are vital.[467]

Unfortunately, the transition to a truly interdisciplinary approach is unlikely to be a smooth one. Even those committed to species conservation are reluctant to break out of the traditional, single-discipline problem-solving mold.[468] This tunnel vision stems largely from the fact that many people are trained in only one discipline, be it science, law, or public policy.[469] The historically narrow problem-solving approaches that result from disciplinism, however, have only hastened the current species and ecosystem crisis.[470] Refusal to see the big picture forces natural resource professionals to continue to "think in boxes and not to transcend those boxes or to question overly much how they fit with other boxes."[471] While disciplinism is intellectually convenient,[472] it is time for us to move into an interdisciplinary realm that enables resource managers to over-

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[465] *Id*.

[466] Wagner, *supra* note 8, at 245; *Policy-Oriented Curricula*, *supra* note 8, at 36. Interdisciplinary slippage occurs when professionals from different disciplines (e.g., legislators and scientists) talk past each other. *See id.*

[467] Conventional problem-solving approaches are often "overly technical, parochial, or promotional (i.e., favoring special interests)." *Leadership*, *supra* note 8, at 13.

[468] *Id.* at 10. "The traditional strategy used until recently [in species and ecosystem conservation] is disciplinism, emphasizing a single discipline, or a few disciplines in a multidisciplinary approach . . . ." Clark, *supra* note 9, at 35; KINZIG ET AL., *supra* note 5, at 2.

[469] *Leadership*, *supra* note 8, at 12. "[N]o environmental policy problem, in particular the loss of species and ecosystems, falls entirely within the boundaries of any one specific discipline. Unfortunately, when most disciplines encounter environmental policy problems, they usually subordinate the problem to their disciplinary perspective, which proves to be theoretically and methodologically limited, and often inadequate." Clark, *supra* note 3, at 18. *See also* Rohlf & Dobkin, *supra* note 55, at 1344 ("Despite the complexities of real world problems, . . . with a few exceptions, most post-graduate programs in both the natural and social sciences have historically placed little emphasis on interdisciplinary learning and cooperation. This lack of educational foundation outside narrow specialties produces professionals who are not well equipped to deal with modern problems facing efforts to manage, protect, and restore biological diversity."). One suggestion for solving this problem is to make sure that scientists better understand the policy-making process, so that they can anticipate the pitfalls and act (and react) accordingly. Pool, *supra* note 85, at 673.

[470] *Leadership*, *supra* note 8, at 9.

[471] David W. Orr, *The Problem of Discipline/The Discipline of Problems*, 7 CONSERVATION BIOLOGY 10, 10 (1993). "The scientific community must accept the need for more regulatory science and thus redirect research to helping provide answers that society deems relevant. This will be hard because drawing inferences beyond the box of a fully tested hypothesis by replicable data [is] a threat to the integrity of science." Tarlock, *supra* note 14, at 152–53.

[472] Such narrowness of thought and specialization is especially common in academia. Orr, *supra* note 471, at 10. Within disciplines, the trend is toward an ever-greater degree of specialization (until experts become those who know more and more about less and less until they know everything about nothing at all).

come narrow problem-solving approaches; adopt appropriate, diverse, innovative models; and lead the country toward more creative, cooperative, and efficient solutions.[473]

b. Toward an Ecosystem-Based Approach

i. Overview

An effective, sustainable conservation regime requires a holistic, ecosystem-based approach. The ESA currently suffers from a serious deficiency insofar as it adopts a piecemeal approach to species conservation rather than comprehensive approach to ecosystem protection. Given that habitat degradation is the primary cause of species extinction[474] and that ecosystem integrity is critical for long-term species survival, approaching species conservation from an ecosystem management standpoint is far more prudent than a species-by-species approach.[475] Adopting a comprehensive, ecosystem-based approach will help us avoid the downfalls of trying to proceed as if each species were an island unto itself.[476]

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[473] *Id.* at 10–11; Elizabeth J. Farnsworth, *Forging Research Partnerships Across the Academic-Agency Divide*, 18 CONSERVATION BIOLOGY, 291 *passim* (2004) (calling for collaboration between academic scientists and natural resource managers); Tarlock, *supra* note 14, at 153 ("This will require the greater integration of available information scattered among the many specialists that exist in science and more effective external communication. In short, scientists will have to learn to think and write like lawyers."). Conservation biology is one discipline that is moving beyond traditional disciplinary boundaries:

> Conservation biology began with a major emphasis on genetics, biogeography, and other ecological and evolutionary issues, but the field is now maturing to encompass other concerns beyond ecology, including economic, legal, and political issues. Because it is so young, the proper balance between the basic and applied science . . . is still being sought.

Brunner & Clark, *supra* note 13, at 52 (quoting G. K. Meffe & S. Viederman, *Combining Science and Policy in Conservation Biology*, 23 WILDLIFE SOC'Y BULL. 327, 327 (1995)).

[474] Habitat degradation often results from exploitative resource extraction practices. People seeking quick gains are more likely to use destructive practices when exploiting our natural resource base. *Leadership*, *supra* note 8, at 10. Such an approach is not sustainable over the long term, and will continue to lead to habitat degradation and species loss. *Id*.

[475] "[O]ne of the inherent limiting features of the ESA[is that] it is species-specific . . . . Notwithstanding its stated purpose of conserving the ecosystems on which listed species depend, the ESA is strikingly short on ecosystem-focused rationale." NRC FINAL REPORT, *supra* note 142, at 316. The Committee further comments: "[A] species-specific focus and an ecosystem-level focus may lead to different management policies and decisions . . . . The dichotomy between the listed species and ecosystems limits the extent to which USFWS and NMFS can use the ESA for ecosystem management." *Id.*

[476] As John Muir correctly noted almost one hundred years ago: "When we try to pick out anything by itself, we find it hitched to everything else in the universe." JOHN MUIR, MY FIRST SUMMER IN THE SIERRA 211 (1911). *See also* Ruggiero, *supra* note 26, at 69–70 ("Altering the relationship between just two elements in the web can lead to radical change in an entire community.").

Adopting an ecosystem management approach would allow scientists to continue to play a key role in species recovery efforts. The principles of ecosystem management acknowledge that ecosystems are too complex ever to be completely understood, but these same principles recognize that we can understand ecosystem relationships and dynamics well enough to develop reasonable models to guide our management regimes.[477] Acknowledging our limited understanding, yet recognizing that we often understand enough, will help us create a more robust, enduring, and successful natural resources management regime.

An ecosystem management approach also allows natural resource managers to incorporate human concerns into the conservation equation.[478] First, the principles of ecosystem management explicitly recognize human uses, needs, and occupancy as integral parts of an ecosystem that must be considered in making management decisions.[479] The concept of ecosystem management does not preordain specific management goals, nor does it preclude resource use or extraction.[480] Rather, ecosystem management seeks to manage human use so as to maintain ecosystem integrity in the long term, which in turn preserves a full range of future management options.[481]

ii. Overcoming Public Resistance

Despite the scientific consensus that maintaining ecosystem integrity ought to be the primary goal of natural resource management, obstacles litter the transitional path to implementation of ecosystem management.[482] One primary hurdle is public resistance to the approach. As with other efforts to protect imperiled species, the public's reception of ecosystem management has been mixed. "[E]cosystem management has been alternately hailed as the future of land management and feared as a sinister plot to lock up public and private lands from economic activity."[483] While

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[477] Ruggiero, *supra* note 26, at 70.

[478] Thus, such an approach might be more palatable to non-conservation interests as well.

[479] One of the fundamental principles of ecosystem management is that "[h]uman uses, needs and occupancy must be considered in making ecosystem-level management decisions." Ruggiero, *supra* note 26, at 44.

[480] *Id.* at 72.

[481] *Id.* at 72, 76. This is not to say that this is an easy goal to achieve. To be sure, there will be "difficult situations where human desires are incompatible with other goals of ecosystem management such as the maintenance of natural diversity." *Id.* at 76.

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> [T]here is general agreement [in the academic and popular literature] that maintaining ecosystem integrity should take precedence over any other management goal . . . . [G]iven the rate and scale of environmental deterioration along with our scientific ignorance of ecological patterns and processes, we are in no position to make judgments about what ecosystem elements to favor in our management efforts.

Grumbine, *supra* note 277, at 32.

[483] George Miller, *Ecosystem Management: Improving the Endangered Species Act*, 6

it is true that no-holds-barred resource use and extraction are not consonant with ecosystem management, that does not mean that all economic activity will be stifled under an ecosystems approach. To the contrary, ecosystem management expressly acknowledges human needs and aims to reconcile "the new goal of protecting ecological integrity and the old standard of providing goods and services for humans."[484] This reconciliation will require managers to apply the best available science, integrate that scientific knowledge into our cultural framework, invite public participation in the planning process, and ultimately overcome public distrust of ecosystem management.[485]

Actively involving local residents in the management process is crucial to allaying their concerns about ecosystem management.[486] The agencies' current processes of "[p]ublishing information filtered bureaucratically and offering alternatives already 'preferred' . . . disempower[s] citizens [and leads to] lack of trust, poor communication, power differentials between stakeholders, turf protection, and lack of public involvement after decisions are made."[487] A first step in affording the public a role in ecosystem management is to establish a forum where citizens can both voice their concerns and learn about the causes and consequences of ecosystem degradation.[488] Such a forum would allow scientists to explain species status

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ECOLOGICAL APPLICATIONS 715, 716 (1996). *See also* Wayne A. Morrissey, *Science Policy and Federal Ecosystem-Based Management*, 6 ECOLOGICAL APPLICATIONS 717, 717–18 (1996) ("The politics of ecosystem management have been polarized around two consensus notions competing for primacy: that a healthy environment is good and that economic growth is good. . . . Many argue that EM is a middle ground, and that these two objectives are not dichotomous.").

[484] Grumbine, *supra* note 277, at 31. Grumbine goes on to note that "[m]uch of the oft-complained 'fuzziness' or lack or precision surrounding ecosystem management derives from alternative views on this point." *Id. See also* Allen Y. Cooperrider, *Science as a Model for Ecosystem Management—Panacea or Problem?*, 6 ECOLOGICAL APPLICATIONS 736, 736 (1996) (citing Norman L. Christensen et al., *The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 665 (1996)).

[485] Jack Ward Thomas, *Forest Service Perspective on Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 703, 703 (1996) ("Implementation of ecosystem management will require the application of the best scientific knowledge and the best technology available" and "[a]pplying ecosystem management involves collaboration of partners (those who make use of the land), land managers, and scientists, with the inclusion and consent of the public, particularly on the public lands."). *See also* Cooperrider, *supra* note 484, at 736–37.

[486] Note that as we move toward an ecosystems approach, other federal, state, and tribal resource agencies (including the U.S. Forest Service, Bureau of Land Management, National Park Service, and state game and fish agencies) and natural resource managers will play a more active role in management discussions.

[487] Grumbine, *supra* note 277, at 34.

[488] *See id.* at 33 ("[C]itizen support for ecosystem management must manifest itself in two areas: ecological literacy and environmental advocacy. . . . I assume here that if people were better informed about the causes and consequences of the biodiversity crisis they would be more supportive of ecosystem management."). For example, in August of 1995 the Bureau of Land Management ("BLM") commissioned twenty-four citizen-based resource advisory councils to help inform BLM's public lands management. Michael P. Dombeck, *Thinking Like a Mountain: BLM's Approach to Ecosystem Management*, 6 ECO-

and ecosystem concepts; managers to describe various possible management strategies; and the public to comment on their concerns and provide their own management suggestions. Scientists could then consider the likely effects of the proposed management actions;[489] managers could assess the plans' feasibilities; and citizens could again contribute their thoughts and ideas to the group. By committing themselves to this kind of three-way dialogue, agencies can ensure both that citizens' concerns are recognized and that public support for ecosystem management is enhanced.[490]

Managers can also promote public involvement by inviting residents to participate actively in the ecosystem management process itself. For example, managers can ask residents to help inform the management process by sharing their intimate knowledge of local conditions.[491] Managers can recruit local residents to help design sampling methodologies and participate in the sampling and monitoring programs.[492] And to retain public interest and demonstrate accountability, agencies can periodically release the results of their monitoring efforts to community members (e.g., through local newspapers or news programs) and solicit feedback on project progress, successes, and failures.[493]

Finally, managers can try to garner support for ecosystem management by emphasizing the benefits that accrue to the public under an ecosystems approach. The most direct benefit is the continued availability of various renewable natural resources. Since both the production and use of renewable natural resources and the continued survival of endangered species directly depend on ecosystem health, an ecosystem-based approach may lead to less restriction and regulation on resource users in the long run.[494] As opposed to the draconian restrictions sometimes imposed under the current emergency-room approach to endangered species management, an ecosystems approach would allow for wise resource use.

LOGICAL APPLICATIONS 699, 700 (1996). These councils are made up of numerous stakeholders, including holders of grazing permits or leases, outdoor recreation representatives, timber industry representatives, environmental organization representatives, elected officials, tribal representatives, academics, and many others. *Id.* The BLM hopes these councils will harness local residents' specialized knowledge and skills, engage them in a transparent decision-making process, and garner their support for ecosystem-based approaches. *Id.*

[489] One way managers can safeguard imperiled species is to continue to ground their decisions in the best available science. Science provides information on what ecological outcomes are possible, which are probable, and which are desirable as far as maintaining ecosystem function. Jack A. Stanford & Geoffrey C. Poole, *A Protocol for Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 741, 742 (1996).

[490] *See generally* Grumbine, *supra* note 277, at 33–34.

[491] Dombeck, *supra* note 488, at 700 (noting that people who rely on public lands often know those lands best, and are generally most affected by ecological degradation).

[492] Peter Alpert, *Incarnating Ecosystem Management*, 9 CONSERVATION BIOLOGY 952, 953 (1995).

[493] *Id.*

[494] Dombeck, *supra* note 488, at 702. *See also* Thomas, *supra* note 485, at 703 ("The protection and restoration of ecosystems is the means to assure that multiple uses can continue to be provided.").

Maintaining ecosystem integrity allows declining species populations to stabilize and perhaps rebound before listing is necessary.[495] If we prevent species from becoming endangered in the first instance, we can avoid the disruptive effects of species listing.[496] Further, intact ecosystems foster the recovery of already-listed species, which allows for subsequent responsible resource use in non-critical areas and eventual delisting.[497] Thus, by communicating with local communities, informing them of the benefits of ecosystem management, and involving them in the management process, agencies may begin to overcome public opposition to an ecosystems approach.[498]

iii. Encouraging Creativity

Another obstacle faced by agencies wanting to implement ecosystem management is that no one-size-fits-all approach to ecosystem management exists. It is true that the realization of on-the-ground ecosystem management will require continuous and concerted effort by managers, scientists, policymakers, and the public. But we must not allow uncertainties, complexities, or obstacles to derail our efforts. Rather, we should view the movement toward ecosystem management as an evolutionary—rather than revolutionary—process.[499] Jack Ward Thomas, former chief of the United States Forest Service (USFS), noted that ecosystem management "is not (and never will be) a complete and polished process ensconced in detailed manuals. Ecosystem management is and will always be 'work in progress' that will undergo continual refinement and improvement as practitioners gain experience and knowledge, and as new technology provides tools to incorporate into the process."[500] As managers and scientists continue to experiment with ecosystem management processes, some difficulties will be overcome and new ones will arise. But however daunting these obstacles appear, they are not insurmountable.

In his article *Ecosystem Management in Practice: the Importance of Human Institutions*, Professor Steven Yaffee discusses a University of Michigan study that reviewed seventy-seven ecosystem management endeavors.[501] These endeavors represented efforts in all states and involved

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[495] Dombeck, *supra* note 488, at 702.
[496] Miller, *supra* note 483, at 715.
[497] *Id.*
[498] Dombeck, *supra* note 488, at 702.
[499] Thomas, *supra* note 485, at 703. *See also* Robert B. Keiter, *Ecosystems and the Law: Toward an Integrated Approach*, 8 ECOLOGICAL APPLICATIONS 332, 339 (1998) ("As the [ecosystem management] initiatives mature, the accumulated lessons should enable us to identify appropriate institutional structures and necessary legal changes required to protect the nation's ecological heritage.").
[500] Thomas, *supra* note 485, at 703.
[501] Steven L. Yaffee, *Ecosystem Management in Practice: The Importance of Human Institutions*, 6 ECOLOGICAL APPLICATIONS 724, 724 (1996). Steven Yaffee is professor of natural resources and environmental policy and the Theodore Roosevelt Chair of Ecosys-

a spectrum of landowners including governments, tribes, corporations, and nonprofit entities.[502] These ecosystem-based approaches differed from traditional management in that they viewed projects on the landscape scale, considered ecosystem complexity (as opposed to single species management), and involved numerous stakeholders.[503]

Yaffee identified several critical components that characterized the most successful of these ecosystem management approaches.[504] The first is collaborative decision-making.[505] Democratic approaches that effectively involve the public tend to be most successful.[506] Engaging the public and explaining the realities of ecosystem management—specifically that it incorporates human needs and economic considerations—can help assuage the concerns of suspicious local residents.[507] Secondly, given the uncertainty inherent in conservation science, successful ecosystem management approaches utilize effective data-gathering processes and networks for disseminating new information.[508] Third, agencies that craft successful ecosystem management approaches reward employee creativity and encourage interagency cooperation.[509] They also empower their employees and promote entrepreneurial activity.[510] And finally, successful ecosystem management plans generally include education programs designed to impart to the public an understanding of ecosystem function and the long-term economic and ecological benefits that can be derived from healthy ecosystems.[511]

iv. Suggestions for a Framework

Between the years of 1992 and 1994, the Marine Mammal Commission sponsored a series of consultations and workshops with scientists and resource managers to search for principles to guide conservation efforts.[512]

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tem Management at the University of Michigan. *See generally* The University of Michigan School of Natural Resources & Environment, Faculty Profile: Steven L. Yaffee, Ph.D., http://www.snre.umich.edu/faculty-staff-directory/faculty-detail.php?faculty_id=30 (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review).

[502] Yaffee, *supra* note 501, at 724.

[503] *Id.*

[504] *Id.* at 725.

[505] *Id.*

[506] *Id.* at 725–26.

[507] Keiter, *supra* note 499, at 336. The BLM emphasizes the importance of education and communication in overcoming public apathy or hostility to ecosystem management approaches. Dombeck, *supra* note 488, at 700. For example, the agency notes that "[a]ll the technical expertise in the world cannot overcome public disinterest in, or worse, distrust of conservation and restoration activities." *Id.* at 701.

[508] Yaffee, *supra* note 501, at 726.

[509] *Id*. *See also* Erica Fleishman et al., *Conservation in Practice: Overcoming Obstacles to Implementation*, 13 CONSERVATION BIOLOGY 450, 451 (1999) (noting that currently, "[b]ureaucracies do not tend to reward innovation").

[510] Yaffee, *supra* note 501, at 726. "[H]aving dedicated individuals who make things happen is as important as having formal policies and programs." *Id.*

[511] *Id.*

[512] *See* Marc Mangel et al., *Principles for the Conservation of Wild Living Resources*, 6

The participants realized that the proper mix of scientific, economic, and social factors will vary depending on circumstances, will differ from place to place, and will change over time.[513] The principles at which they arrived sought to recognize: the need for both consumptive and non-consumptive use of resources; the challenge of balancing ecosystem health and the quality of human life; and the means of attaining an enduring relationship between humanity and wild living resources.[514] I would like to review some of those principles, which I believe can be used to guide an ecosystem-based, adaptive management approach.

Principle I states that, "[m]aintenance of healthy populations of wild living resources in perpetuity is inconsistent with unlimited . . . demand for those resources."[515] Clearly, humans cannot seek infinite returns from a finite resource.[516] In order to achieve sustainability where living resources are concerned, we must focus on "living off of nature's interest instead rather than its capital."[517] That is, we must take no more than what natural processes can replace.[518] If our understanding of natural processes changes over time as a result of the findings of scientific research, or as climatological or other conditions change, resource managers must be allowed to revamp resource protection plans accordingly. This is not too different from what state game managers have done for years when setting bag limits for hunting. In an ecosystem-based, adaptive management context, the concept would simply be expanded to explicitly cover our evolving knowledge of ecosystem processes and functions.[519]

Principle II urges us to "maintain[ ] biological diversity at genetic, species, population, and ecosystem levels."[520] By ensuring that we "work within the constraints of natural law . . . and biological dynamics" and strive to preserve essential ecosystem functions, we can maintain "the fullest possible range of options for future generations" and minimize changes

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ECOLOGICAL APPLICATIONS 338, 339 (1996).

[513] *Id.* at 340.

[514] *Id.*

[515] *Id.*

[516] *Id.*

[517] *Id.*

[518] *Id.*

[519] The authors of the study suggest the following mechanisms to help implement this principle:

> (1) Recognize that the total impact of humans on wild living resources is the product of human population size, per capita consumption, the impact on the resource of the technologies applied, and incidental taking and habitat degradation caused by other human activities. Take appropriate actions that recognize these characteristics[;] . . . (2) Recognize that if urban areas and other intensely used land areas were more efficient, safer, and more pleasant, there would be a greater chance of conserving wild resources.

Id. at 340–41.

[520] *Id.* at 341.

in ecosystem structure and function that are irreversible in the short term.[521] The most effective way to do this is to manage total human impact on ecosystems.[522] If managers and scientists can identify the critical elements of a given ecosystem (e.g., nutrient dynamics, species' life history requirements, source areas), they can design a management plan that preserves those features and functions while allowing for a wide range of human activities.[523] Researchers should also attempt to discern what critical thresholds and synergies characterize a given environment, and monitor the system to ensure that thresholds are not crossed.[524] Finally, managers should prevent the disruption of food webs; specifically, they should maintain the diversity of basal and predatory species.[525] This type of comprehensive, process-oriented approach is inherently adaptive and dynamic, and can help to maintain ecosystem integrity.[526]

The third principle suggests that the "[a]ssessment of the possible [biological,] ecological and sociological effects of resource use should precede both proposed use and proposed restriction or expansion of ongoing use of a resource."[527] Ideally this assessment would occur prior to significant capital investment and before severe degradation occurs.[528] For activities already occurring, managers should assess whether the use is having detrimental impacts.[529] Since it would be prohibitively costly and difficult—if not impossible—to gauge all the possible impacts of a proposed use, managers must build contingencies into management plans and monitor ecosystems so that adverse effects can be detected prior to their reaching harm-

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[521] *Id.*
[522] *Id.*
[523] *Id.* at 341, 342.
[524] *Id.* at 343.

> For example, a pathogen may suddenly become a plague once it reaches a threshold density; reproduction may not occur until population densities pass a threshold high enough for individuals to find each other; and populations of a given species may only be viable above some critical threshold of patch (habitat) size, below which a refuge is ineffective. . . . Similarly, synergisms—interactive effects of different agents in which the total cooperative effect is positive and greater than the sum of the individual effects—can have far-reaching influences on conservation. For example, seals in the North Sea may have been weakened by pollution, which allowed their decimation in 1988 by viral disease.

Id. (internal citations omitted).

[525] *Id.* at 342–43. Basal species are the producers; that is, they "are self-supporting and their population growth is limited in part by interspecific competition with other basal species." Ebenman et al., *supra* note 444, at 2592. A predatory species preys on, or consumes "species at the trophic level next below it." *Id.*

[526] *Id.* at 342.

[527] Mangel et al., *supra* note 512, at 343. Managers can minimize the impact on local communities by affording short-term socioeconomic considerations greater weight where existing resource-use industries are concerned, whereas greater weight can be given to long-term biological considerations for new or developing industries. *Id.* at 345.

[528] *Id.* at 344.

[529] *Id.* at 343.

ful levels.[530] By authorizing resource use and extraction activities contingent upon a plan that incorporates effective monitoring and experimental management, "[r]esource use can be structured to provide information about the resource."[531]

Finally,[532] the Marine Mammal Commission report emphasizes that an adaptive, ecosystem-based management approach is unlikely to be successful unless communication between scientists, resource managers, and interested stakeholders is interactive, reciprocal, and continuous.[533] The communications must be targeted to their proper audience, commence at an early stage of decision-making, be respectful, and convey relevant information in an accurate light.[534] Goals, objectives, and uncertainties should be stated clearly, and information should be explained in both ecological and socioeconomic terms.[535] Those involved should be made fully aware of the ecological and socioeconomic costs, benefits, and risks of different courses of action.[536] Common misperceptions and conflicts of interest must also be discussed and clarified. For example, science demands continual monitoring and refinement, resource users desire final answers and certainty, and decision-makers must act decisively and quickly.[537] By ensuring that interested parties understand that these conflicts exist; by explaining the possible ramifications of proceeding under any given set of assumptions; and by identifying situations and circumstances where adaptive management adjustments might come into play and informing stakeholders of their likelihood, managers can reduce the chance that any stake-

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[530] *Id.*

[531] *Id.* at 345. Specifically:

> The plan for acquiring data and information during resource use should clearly identify the data and underlying assumptions, the possible consequences of any uncertainties concerning the validity of the assessment(s), and the additional baseline studies, deliberate perturbation experiments, or monitoring programs proposed to be carried out to resolve the uncertainties. The plan should take into account the response times of the target and associated species. Finally, the observers associated with data collection must be independent of the organization and preferably the country that is financing the program.

Id.

[532] Mangel et al. include more principles for conservation in their article, but I have limited the discussion to those principles I found most relevant to this discussion of ways to implement an adaptive, ecosystem-based approach. *See* Mangel et al., *supra* note 512.

[533] *Id.* at 352.

[534] *Id.*

[535] *Id.*

[536] *Id.*

[537] *Id.*; Nat'l Center for Ecological Analysis & Synthesis, *Special Call for Proposals: Scientific Foundations for Ecosystem-Based Management*, http://www.nceas.ucsb.edu/nceas-web/opportunity (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review) (noting that "[f]requently there is tension between the needs of managers and policy-makers to make quick decisions and the desires of scientists to understand all the dimensions of ecosystem complexity").

holders will feel misled.[538] To the extent possible, managers should devise institutions and procedures capable of facilitating this transdisciplinary discussion and analysis.[539]

c. Toward an Adaptive Approach

i. Overview

As the Marine Mammal Commission report recognized, one of the key features of a successful ecosystem-based, interdisciplinary approach to conservation is a commitment to flexibility. Many of our current environmental laws are rooted in the notion of maintaining a static, balanced state of nature.[540] This "anachronistic orthodoxy" is out of step with the emerging ecosystem science and encourages finality rather than ongoing, flexible, dynamic management.[541]

One way to achieve the desired flexibility is through a commitment to adaptive management.[542] Adaptive management relies on the experimental ideals of basic science and allows decisions to be made in the face of uncertainty by treating management strategies as "modifiable experiments."[543] As such, it allows managers to tweak the assumptions underlying their management strategies as new information becomes available.[544] Adaptive management thus allows for modification and encourages innovation as managers attempt to solve conservation-related problems.[545] Further, the flexibility inherent in an adaptive management regime may make any decision more palatable to a broad range of stakeholders since it reduces the need for scientific near-certainty and results in an action plan that may be modified over time.[546]

Adaptive management also comports with principles of ecosystem management and the nonequilibrium paradigm.[547] Under the currently ac-

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538 Mangel et al., *supra* note 512, at 352; Jamie Rappaport Clark, *The Ecosystem Approach from a Practical Point of View*, 13 Conservation Biology 679, 680 (1999).

539 Mangel et al., *supra* note 512, at 353.

540 Wiener, *supra* note 290, at 333.

541 *Id.* at 334.

542 Brunner & Clark, *supra* note 13, at 54. *See also* Boersma et al., *supra* note 104, at 648 ("[O]pportunities for adaptive management must be seized.").

543 Tarlock, *supra* note 14, at 153.

544 Brunner & Clark, *supra* note 13, at 54. *See also* Ruckelshaus et al., *supra* note 12, at 695 (noting that a primary problem in endangered and threatened species management is that "the public, and even some scientists, have ended up being too satisfied with an absence of data, and have been willing to accept the expert opinion systems as a permanent substitute for empirical information.").

545 Brunner & Clark, *supra* note 13, at 54.

546 *See* Tarlock, *supra* note 14, at 153–54.

547 The nonequilibrium paradigm represents our emerging understanding that ecosystems, rather than reaching a static state of nature, are in continual, dynamic flux. *See, e.g.*, Wiener, *supra* note 290, at 333–34. "[T]he 'natural state' of the environment is a moving target or a meaningless concept . . . . [T]he 'natural state' [cannot be defined] when eco-

cepted scientific paradigm, an ecosystem is best viewed as a complex, constantly changing mosaic that never reaches a true equilibrium state.[548] The idea that an ecosystem does not reach equilibrium not only favors adaptive management, it undercuts any argument for the appropriateness of a pure "sound science" initiative. If a system is constantly changing, sometimes in unknowable and unpredictable ways, we could never have a requisite, definitive scientific foundation upon which to act. Adaptive management rolls with the nonequilibrium paradigm's punches, allowing agencies to make resource management decisions without committing them in a way that forecloses adaptive possibilities for the future.[549] Adaptive management allows species and ecosystem management themselves to be evolutionary, integrating better scientific knowledge as it becomes available—without insisting on "definitive" knowledge before a management plan is formulated and implemented.[550]

ii. Overcoming Resistance to Uncertainty

One of the main criticisms of adaptive management is that it "runs counter to a climate of regulatory certainty or stability."[551] Critics argue that the uncertainty inherent in an iterative, adaptive approach precludes industries from making the investments necessary for resource use or exploitation.[552] According to their argument, resource use decisions are all

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logical systems and species are ever in flux. The search for stasis is inevitably frustrated by nature's dynamic reality." *Id.* at 339–40.

[548] Ruggiero, *supra* note 26, at 36.

> A fundamental principle of ecosystem-level management is to provide for long-term integrity and natural diversity within ecosystems. This principle must be considered in the context of ecosystems as dynamically changing systems. Coupled with this principle is the necessity of providing for the maintenance of evolutionary and ecological processes such as disturbance regimes, hydrological processes, nutrient cycles, etc.

Id. at 44.

[549] Brunner & Clark, *supra* note 13, at 50, 51.

[550] *Id.* at 49. Such evolution is seen in all aspects of American jurisprudence: "[O]ver time, the Constitution, statutes, regulations, and directives are adapted to diverse and changing circumstances, and social evolution is biased according to the consent of the governed." *Id.* at 50.

[551] E-mail from John D. Leshy, Harry D. Sunderland Distinguished Professor, University of California, Hastings College of Law, to author (Feb. 12, 2005, 18:04 EST) (on file with the Harvard Environmental Law Review). This criticism comes from interested parties across the conservation spectrum. While it is more commonly attributed to resource users, environmentalists too may be reluctant to promote adaptive management out of a fear that ecosystems deemed healthy might be opened up for development.

[552] "Adaptive management . . . presumes that it is easier to change direction in the long term than is generally the case once vested interests are created." Yaffee, *supra* note 501, at 725. *See also* Mangel et al., *supra* note 512, at 352–53 ("Successful conservation requires reconciliation of spatial and temporal perspectives among management agencies, relevant stakeholders, and the ecological character of the resource . . . . The disparity between economic and ecological time scales presents a great challenge because the economic system

or nothing and once and for all; once the decision to use a resource has been made, industry cannot (or should not be expected to) change course. While this argument has some intuitive appeal, a closer examination reveals it to be more of a diversionary tactic than an insurmountable problem.[553]

Just as you can never have certainty in science, you can never have certainty in business endeavors.[554] Resource use industries and developers deal with uncertainty every day, in every decision they make. For example, the oil industry faces numerous uncertainties including exploration success, exploration cycle time, fluctuating oil prices, industry development costs, personnel changes, rig additions, pipeline access, oil spill risk, terrorist act risk, and competition.[555] The timber industry must deal with uncertainties from market fluctuations, variable tree growth rates, natural disasters (e.g., forest fires, tornadoes, insect infestations), harvesting costs, and optimum harvest strategy.[556] Resource users long ago found ways to act despite tremendous uncertainties, including uncertainty from the regula-

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responds to change much faster than the ecological system[.]").

[553] Telephone Interview with Charles B. Carden, Senior Vice President and Chief Fin. Officer, John H. Harland Co. (Mar. 23, 2005). Further, the fact that certain industrial trade associations, such as the American Forest & Paper Association (AF&PA), have actively endorsed adaptive management supports the notion that extractive industries could benefit from such an approach. AF&PA is the U.S. national trade association for the forest, paper, and wood products industry. *See* Am. Forest & Paper Ass'n, About AF&PA, http://www.afandpa.org/Template.cfm?section=About_AFandPA (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review). Its members include Boise Cascade, Louisiana-Pacific, and Weyerhauser. *See* Am. Forest & Paper Ass'n, Membership: List of Member Companies, http://www.afandpa.org/Content/NavigationMenu/About_AFandPA/Membership/List_of_Member_Companies/List_of_Member_Companies.htm (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review). The AF&PA

> accepted ecosystem management for its potential to reduce conflict over the management (or lack thereof) of federal lands . . . . AF&PA recommended the adoption of several key principles that are essential to making ecosystem management, as a policy, a success. They include: . . . (6) . . . adaptive management. . . . A coordinated program of research and monitoring, which builds on existing knowledge, is necessary to develop sound adaptive management strategies.

Anne E. Heissenbuttel, *Ecosystem Management—Principles for Practical Application*, 6 ECOLOGICAL APPLICATIONS 730, 730 (1996) (citation omitted).

> AF&PA's position paper (1993) on ecosystem management highlights the importance of adaptive management in implementing ecosystem management. . . . Without the flexibility to adapt to local and regional conditions, managers will be unable to successfully test their assumptions; distinguish activities, programs, and policies that work from those that do not; and improve their ability to make and implement decisions that will achieve desired results in the future.

Id. at 732.

[554] Telephone Interview with Carden, *supra* note 553.

[555] *See* Arthur D. Little, Seminar Series: Methods in Making Decisions Under Uncertainty (Oct. 8, 1998), http://www.fun-oil.org/081098/Mcmahon/sld006.htm (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review).

[556] *See generally* Runsheng Yin, *Combining Forest-Level Analysis with Options Valuation Approach—a New Framework for Assessing Forestry Investment*, 47 FOREST SCI. 475 (2001).

tory climate. Any contention that the uncertainty inherent in adaptive management makes resource use or extraction infeasible is simply disingenuous.

Nor are the ideas of adaptability and flexibility novel or extraordinary. "A thirty-year long strand of [the forest economics] literature emphasizes the importance of valuing managerial flexibility in the context of irreversible harvesting decisions, when forest product prices are volatile relative to harvesting costs."[557] In any industry, the processes of decision-making under uncertainty and of building flexibility and adaptability into corporate management plans represent sound business practices.[558]

The question, then, is not whether the uncertainties inherent in adaptive management invalidate the method. Rather, the relevant question is how to deal with the particular uncertainties presented by an adaptive approach. A resource user must mitigate the risk of adaptive management the way he mitigates all other risk: he must estimate the risk's potential cost (e.g., through expected return calculation or discounted cash flow analysis)[559] and protect himself accordingly.

One way a resource user can protect himself is through diversification. The concept is similar to portfolio management: by making numerous investments (e.g., by harvesting timber from various sites), a resource user can avoid a potentially catastrophic loss. A second way a resource user can manage uncertainty is to form research or study groups charged with evaluating risk.[560] By employing scientists and other experts that can objectively assess a proposed development's real risks, a resource user can make a more informed investment decision. Finally, we may consider the idea of habitat management insurance. Just as insurance companies regularly insure for risks of natural disaster, perhaps they could insure against ecosystem disasters that would curtail resource users' extraction activities. If adaptive management becomes the norm, insurers could become skilled at assessing the uncertainties inherent in adaptive management situations and insure resource users against potential losses.

No one contends that the shift to an adaptive, ecosystem-based approach will be easy.[561] But the complexities inherent in an adaptive approach should not be used as an excuse to avoid implementing such a program.[562]

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[557] M. C. Insley & K. Rollins, On Estimating the Costs of Regulations Limiting Flexibility in Timber Harvest Decisions: A Multi-Rotational Real Options Model (Discussion Paper, Mar. 1, 2004), http://64.233.187.104/search?q=cache:CnkO8zJHxcgJ:www.arts.uwaterloo.ca/~minsley/ifm_revised.pdf+&hl=en (on file with the Harvard Environmental Law Review). Methods of decision-making in the forestry context range from the use of Markov Decision Process models and simulation, to financial and real options evaluation. *Id.*

[558] Telephone Interview with Carden, *supra* note 553.

[559] These are just two examples of the numerous economic and financial models that provide means of building risk into decision analysis. Telephone Interview with Carden, *supra* note 553.

[560] Telephone Interview with Carden, *supra* note 553.

[561] "[C]hange does not always come easily, peacefully, or in a planned manner." Grumbine, *supra* note 277, at 35.

[562] Stanford & Poole, *supra* note 489, at 742. *See also* Mangel et al., *supra* note 512, at

If we commit to an adaptive, ecosystem-based approach, we can expect both short- and long-term successes including the maintenance of viable populations, preservation of ecosystem types, and improvement of conditions in watersheds, rivers, habitats, and impacted communities.[563] Ultimately, "[t]he choice is ours—a world where the gap between people and nature grows to an incomprehensible chasm, or a world of damaged but recoverable ecological integrity where the operative word is hope."[564]

d. Toward an Integrated Approach: From Theory to Practice

i. The Northwest Forest Plan

The Northwest Forest Plan ("NFP"), initiated during the Clinton administration in response to the spotted owl (*Strix occidentalis caurina*) controversy, represented "the first systematic, broad-scale attempt by any administration to apply an ecosystem approach to resolve a natural resource management issue."[565] The NFP enabled federal agencies to attain social and economic benefits (i.e., a predictable federal timber sale program) while complying with the ESA and other environmental laws.[566] The Plan's focus on utilizing federal lands for listed species protection allowed more intensive economic utilization of the region's private and state lands, and, while adaptive, ultimately provided more certainty and stability for local landowners.[567] While the scale, cost, and unique circumstances triggering

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346 ("Uncertainty should be incorporated into management programs in the context of the goals of the program, rather than dismissed as ignorance or noise, or used as an excuse to postpone management because not enough is yet known about the system.").

[563] *See* Grumbine, *supra* note 277, at 35 (suggesting that "over the short term, success means making significant, measurable progress toward maintaining viable populations, representing ecosystem types, etc."); JAMES PIPKIN, THE NORTHWEST FOREST PLAN REVISITED 11 (1998), *available at* http://www.reo.gov/library/reports/NFP_revisited.htm (on file with the Harvard Environmental Law Review). For an example of an adaptive management framework, see generally Nick Salafsky et al., *Improving the Practice of Conservation: A Conceptual Framework and Research Agenda for Conservation Science*, 16 CONSERVATION BIOLOGY 1469 (2002).

[564] Grumbine, *supra* note 277, at 35.

[565] PIPKIN, *supra* note 563, at 2.

[566] *Id.* at 2, 3.

[567] *Id.* at 3, 23. Habitat conservation plan agreements, "no surprises" and "safe harbor" initiatives, and use of ESA § 4(d) all offered some measure of predictability for resource-dependent communities and industries. *Id.* at 24. Habitat conservation plans coupled with the "no surprises" initiative provide landowners with assurances that no additional land use restrictions will be imposed; the "safe harbor" initiative incentivizes landowners to voluntarily conserve imperiled species habitat. *Id.* ESA § 4(d) provides private landowners with small holdings relief for "take" of endangered species. *See id.* Not that the NFP has been universally embraced, however. The NFP has been "only partially accepted by the involved publics with competing groups often accepting only those parts fitting their values and rejecting others. Some groups find the failure to meet the timber targets unacceptable. Other factions question the need to harvest old-growth trees or even any trees from the national forests. Adaptive management practices, which could result helping to meet [sic] timber goals, are also rejected." *The Northwest Forest Plan: Hearing Before the Subcomm.*

the NFP are unlikely to be replicated, the Plan's successes demonstrate the feasibility of moving toward "(1) landscape-level planning, (2) collaborative agency efforts, (3) broader public participation, and (4) a balance of economic, social, and ecological interests."[568]

The NFP expressly sought to integrate science, economics, and social objectives with management in an adaptive, ecosystem-based management model.[569] The Plan's successes in achieving this integration provide us with some guidance on how best to deal with the practical difficulties that arise in implementing an ecosystem-based, adaptive approach. One way of dealing with the difficulties inherent in an adaptive approach is to establish formal mechanisms that "inject the science focus into . . . management activities and . . . ensure that science/policy coordination occurs."[570] Because the best available science is crucial to the success of any ecosystem management effort, scientists must remain involved in all aspects of the management process.[571] Scientists can help further managerial goals by using "the[ir] expertise to identify areas of uncertainty and to devise a range of actions along with monitoring methods that will provide a feedback loop."[572] As discussed in Part IV.B.3.b.ii, *infra*, an open forum af-

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on Forests and Pub. Land Mgmt. of the S. Comm. on Energy and Natural Res., 107th Cong. (2001) (statement of Nancy Graybeal, Deputy Regional Forester, Pacific Northwest Region, U.S. Forest Service), *available at* http://www.fs.fed.us/congress/2001_testimony/10_24_01_Graybeal_on_NW_Forest_Plan.htm.

568 Pipkin, *supra* note 563, at 5–6. James Pipkin, former Director of the Department of the Interior Office of Policy Analysis, outlines several useful and proven concepts that emerged from the NFP effort. *Id.* at 6. First, stakeholders should work toward creating a mutually agreeable common "vision" to guide the management effort. *Id*. All interested parties, including (but not limited to) state, tribal, and local governments, should be afforded the opportunity to directly participate in the management process. *Id.* Key participants should establish and participate in forums and work together to implement the plan. *Id.* Agencies should establish interagency staffing arrangements and consider personnel exchanges. *Id.* Regulatory processes should be efficient and site-specific. *Id.* Data collection and on-the-ground management activities should be improved and should provide for consistent information. *Id.* Finally, research and monitoring plans should be joint endeavors designed to provide the best scientific information to assist decision-makers and validate plan results. *Id.*

569 *Id.* at 52–53.

570 *Id.* at 53.

571 "The active use of the best scientific knowledge is a fundamental principle of ecosystem management [itself]." *Id*. at 52. Specifically, science critically informs our descriptions of ecosystem structure and function; our ability to assess any particular system's vulnerability to stress; the establishment of effective restoration techniques; and the best means of monitoring ecosystem change. *Id*.

572 Rappaport Clark, *supra* note 538, at 680. Jamie Rappaport Clark calls for help from scientists in devising adaptive ecosystem management plans:

> The USFWS would embrace the participation of outside scientists in this endeavor. In addition, scientists can offer their knowledge and expertise to USFWS ecosystem teams to help us write, review, and revise our plans. They can also help us devise ways to monitor and evaluate our progress. Managers need help in identifying the biological goals and objectives they are striving toward . . . . Scientists also need to help us relate to the public; we need to explain our management decisions to the public and explore alternatives with them . . . . [They can do this by

fords scientists the opportunity to explain local ecosystem dynamics and the ramifications of various management actions while simultaneously allowing managers and the public to express their concerns and needs.[573] Thus, while ensuring that scientists continue to inform the management plan, this process is shaped by a variety of values.

James Pipkin, former director of the Office of Policy Analysis at the Department of the Interior, further maintains that "adaptive management . . . must be a cornerstone of any long-term plan."[574] He suggests that a successful adaptive approach depends on: (1) a well-defined baseline; (2) a sufficient quantity of quality information to fulfill statutory planning mandates; (3) agencies willing to invest in an adaptive approach; and (4) permissive enough planning regulations.[575] Pipkin recognizes that an adaptive approach will not be easy, but urges agencies to strive to "evaluate and respond to new information."[576] The adaptive, ecosystem-based approach embodied in the NFP "represents a new way of doing business that is far preferable to the old way."[577] He advocates an approach that permits ongoing reevaluation and adjustment, provides for monitoring and evaluation of progress, and establishes "adaptive management areas" that can be used for ecological and social experimentation and innovation.[578]

Pipkin also emphasizes that while an adaptive, ecosystem-based approach may be complex and burdensome in some respects, the traditional approach may be worse.[579] He cites the situation in the Pacific Northwest prior to implementation of the NFP as a case-in-point:

> Prior to the Northwest Forest Plan, the timber program had been subject to a number of injunctions and to a process that often resulted in a need to start project planning over again. The inefficiency and the additional expense involved in that process, though hard to quantify, are huge. Viewed narrowly, the [NFP] planning process may be regarded as more cumbersome than normal agency

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> using] the scientific data to frame conservation issues in the context of economic consequences and human health.

Id. at 680–81.

[573] PIPKIN, *supra* note 563, at 53.

[574] *Id.* at 9, 43.

[575] *Id.* at 69.

[576] *Id.* at 9.

[577] *Id.* at 13.

[578] *Id.* at 17. "Adaptive management areas" are "landscape units designed to encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives." *Id.* at 43. They "provide a diversity of biological challenges, intermixed land ownerships, natural resource objectives, and social contexts." *Id.* These areas, described as essential to the long-term success of the NFP, "provide managers with flexibility, discretion, and opportunity to adapt practices to local circumstances . . . [and] offer both the responsibility and the opportunity to begin to learn how to more effectively manage the regional landscape." *Id.*

[579] *Id.* at 26.

> processes. However, viewed against the historical framework of stop-and-start planning, the current process represents considerable progress.[580]

The NFP allowed the timber-sale program to recommence, this time in a sustainable manner.[581] The plan balanced timber production with habitat protection, demonstrating that achievement of such dual goals is possible.[582] Such plans, in the words of Pipkin, represent "the wave of the future."[583]

ii. An Integrated Approach to Species Conservation: Efforts for Reform

Commentators disagree as to whether the prevailing statutory regime is conducive to an adaptive, ecosystem management approach. Some believe the statutory support for agencies to engage in ecosystem management is already in place.[584] Others, however, do not find translating on-the-books statutory mandates to on-the-ground ecosystem management to be quite so simple.[585] In many senses, however, the most important question is not whether the current statutory framework endorses ecosystem management but whether our environmental laws should expressly incorporate an ecosystems approach. This question is especially relevant with respect to the proposed reforms of the Endangered Species Act. From a scientific standpoint, the answer to whether the ESA should incorporate ecosystem management is clearly yes: any meaningful effort to preserve species necessarily requires preserving the ecosystems on which those species depend. By acknowledging the nexus between ecosystem health and species welfare, an ecosystem-based approach addressing the root causes of a species' decline better promotes the Act's goal of species protection.[586]

[580] *Id.*

[581] *Id.* at 27–29.

[582] *Id.* at 24.

[583] *Id.* at 47.

[584] Yaffee, *supra* note 501, at 726. For example, Jack Ward Thomas described the purpose of the Endangered Species Act as "the maintenance of ecosystems with threatened and endangered species as a surrogate." Thomas, *supra* note 485, at 704. *See also* Miller, *supra* note 483, at 715 ("The [Endangered Species Act] explicitly adopts the purpose of preserving ecosystems for endangered species and requires many habitat conservation measures."). Since the ESA prioritizes species protection across boundary lines (i.e., it "follows habitat rather than political boundaries"), the Act implicitly fosters an ecosystem approach. Keiter, *supra* note 499, at 334–35. Transboundary approaches are especially critical in the West, where the checkerboard pattern of private and public landholdings (a relic of the railroad era) still predominates in some areas. *See id.* at 336.

[585] *See* Keiter, *supra* note 499, at 334. For example, University of Utah law professor Robert B. Keiter notes that even the Endangered Species Act is not entirely consistent with an ecosystem approach because it expressly demands protection of individual species rather than entire ecosystems. *Id.* at 335.

[586] *See* Miller, *supra* note 483, at 715–16.

I would further argue that the answer to whether the ESA should incorporate ecosystem management is also a resounding yes from a public interest perspective. Incorporating ecosystem management principles into the Endangered Species Act would benefit not just at-risk species, but humans as well. Science-based ecosystem management would reduce the likelihood that species will become endangered in the first instance. It also affords already listed species a better chance of recovery and thus lifts some of the burden of protecting species off resource users and allows responsible economic activity to occur.[587] Further, agencies have been able to devise ecosystem management approaches like the NFP that effectively engage the public and produce scientifically grounded management plans. As we move forward, we can look to those plans for ideas of how to implement a successful ecosystem management vision.

Ideally, policymakers will become informed enough about the science and policy rationales behind ecosystem management to support its incorporation into the ESA.[588] It appears that some policymakers already support the ecosystem management concept. For example, California Congressman George Miller has suggested several ways of incorporating ecosystem management principles into the Endangered Species Act.[589] First, he proposes a new section that would promote "proactive legislative proposals for 'preventing endangerment.'"[590] This new section would allow federal and state governments to collaborate in identifying at-risk species and ecosystems.[591] Miller suggests that states then be allowed to use this information to craft ecosystem-protection agreements with the Secretary of the Interior.[592] Under these agreements, the states would take various actions to protect species and ecosystems; in return, "the Secretary would agree to forego certain enforcement activities under the [ESA]."[593] Proper monitoring of ecosystem health and species populations would enable the governments to gauge the effectiveness of the state plan.[594] If after five years the species had not recovered, the agreement could be renewed or the usual ESA mandates could take effect.[595]

Congressman Miller also suggests incorporating ecosystem management principles into the ESA's species recovery process.[596] In doing so,

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[587] *Id.* ("[T]his approach may reduce economic impacts by limiting the restrictions on human activity, rather than providing a new laundry list of prohibitions for each species listed.").

[588] Since policymakers are capable of revisiting and amending environmental laws such as the ESA, they play a vital role in species conservation efforts. Grumbine, *supra* note 277, at 33.

[589] Miller, *supra* note 483, at 715.

[590] *Id.* at 716.

[591] *Id.*

[592] *Id.*

[593] *Id.*

[594] *Id.*

[595] *Id.*

[596] *Id.*

managers increase the probability of species recovery and subsequent delisting. Fewer imperiled species means fewer draconian restrictions on resource use, which benefits local landowners and other stakeholders.[597] Another way of incorporating ecosystem management into the ESA's recovery process is to emphasize the use of federal lands for species recovery efforts.[598] Heavier reliance on federal lands will reduce pressures on private landowners, while at the same time enhancing species recovery efforts.[599] Such an approach also allows federal agencies to prioritize plans that would benefit multiple species.[600] Further, it encourages agencies to collaborate in their management decisions, reducing fragmented agency action.[601]

Adaptive, ecosystem-based management regimes will better allow us to confront and cope with the intense resource conflicts that are arising with increasing frequency. The 2001 Klamath Basin situation provides a stark example of the shortcomings of our current management regime. It demonstrates just how pressing is the need for a long-term, comprehensive, flexible approach toward species conservation and provides us with a glimpse of the type of conflict that will continue to arise if we do not act soon.

V. The Klamath Basin 2001

A. *Background*

The 2001 Klamath Basin controversy clearly demonstrates the complex interactions between the ESA, environmental science, cultural values, and Western water law.[602] It further illustrates the urgent need for a new approach to resource conservation and management, one that seeks sustainability and integrity. At the same time, it is a glaring example of how adherence to certain lawmakers' conceptions of "sound science" is untenable in the ESA context.

The Klamath Basin controversy, years in the making, came to a head during the summer of 2001 when drought conditions led the Bureau of Reclamation to close the headgates of the federal Klamath Project.[603] The clo-

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[597] *Id.*

[598] *Id.* This approach was successfully used in the NFP. For a more in-depth discussion of the methods used in the Northwest Forest Protection Plan, see Pipkin, *supra* note 563.

[599] Miller, *supra* note 483, at 716.

[600] *Id.*

[601] *Id.* ("Where the Bureau of Land Management, Forest Service, and Fish and Wildlife Service all own lands within a single ecosystem or a single species' habitat, these new provisions would focus efforts and encourage cooperation among the agencies in their management decisions.").

[602] While it peaked in 2001, the Klamath Basin situation continues to be cited in the press. *See, e.g.*, Dean E. Murphy, *$626 Million to Protect Wildlife Along Colorado River*, N.Y. Times, Apr. 5, 2005, at A20 ("In 2001, the federal government cut off irrigation water to Klamath farmers in a year of record drought to protect the endangered suckerfish, a move that angered farmers and set off a flurry of attacks on the Endangered Species Act.").

[603] Doremus & Tarlock, *supra* note 142, at 316. The Klamath Project is a federal rec-

sure stemmed from the Bureau's obligations under the ESA to protect several listed fishes including the shortnose sucker (*Chasmistes brevirostris*), Lost River sucker (*Deltistes luxatus*), and coho salmon (*Oncorhynchus kisutch*).[604] The closure also represented the first time that the ESA had sharply curtailed water delivery from a federal water project.[605] Environmentalists, regional Indian tribes, and coastal fishermen were overjoyed that the government was taking steps to protect the fisheries; farmers were outraged that the government would dare to touch "their" water.[606]

While the exact contours of the ESA-water law interface remain unclear, it appears the ESA overrides state water rights and contracts when it is necessary to protect species.[607] Determining what substantive protections the ESA requires or permits is considerably more difficult. For example, exactly how much and what kind of scientific data must wildlife agencies have before taking a given action to protect a listed species? These types of uncertainties were brought to the fore during the Klamath Basin crisis of 2001.

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lamation project that supplies water to approximately 240,000 acres of irrigable cropland in South-central Oregon and North-central California. U.S. Bureau of Reclamation, Klamath Project: General Description, http://www.usbr.gov/dataweb/html/klamath.html (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review).

[604] NRC Final Report, *supra* note 142, at 1. Probable causes for the sucker species' decline include habitat alternation, poor water quality, water management, overfishing, and competition from alien species. *Id.* Likely causes of the salmon's decline include loss of habitat, poor water quality, water management, and overfishing. *Id.* This view is in large part consistent with a consensus among salmon biologists that four major anthropogenic causes of salmon declines include habitat degradation, harvest practices, hydroelectric dams and other impoundments, and fish hatchery proliferation. Ruckelshaus et al., *supra* note 12, at 679.

[605] Doremus & Tarlock, *supra* note 142, at 279. The closure reduced normal spring and summer deliveries to 1400 farmers by ninety percent, affecting up to 210,000 acres of pasture, wheat, potatoes, grass hay, barley, onions, sugarbeets, horseradish, and mint. *Id.* at 284.

[606] *Id.* at 284, 287, 297, 321, 337. Under the prior appropriation doctrine, Western water rights represent "quasi-customary entitlements" more than "clearly demarcated property rights." Doremus & Tarlock, *supra* note 142, at 302. The transformation of these entitlements into full-blown property rights requires a basin-wide adjudication. *Id.* Therein lies the rub in the Klamath Basin situation: the irrigators' underlying water rights have never been quantified. *Id.* at 301. A general adjudication led to an alternative dispute resolution forum begun by the state of Oregon, which involves landowners, Indian tribes, and the federal government, and remains incomplete. *See id.* at 302; Or. Water Res. Dep't, Klamath Basin Adjudication, http://www.wrd.state.or.us/ORWD/ADJ/index.shtml (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review); Or. Water Res. Dep't, Klamath Alternative Dispute Resolution, http://www.wrd.state.or.us/OWRD/ADJ/klamath_adr_index.shtml (last visited Dec. 4, 2005) (on file with the Harvard Environmental Law Review). Since no federal rights have been quantified, no limitations had historically been imposed on Project users. Doremus & Tarlock, *supra* note 142, at 301. Thus, when 2001 rolled around, Project users were unwilling to accept anything other than a continuation of the status quo. *Id.* at 302–03.

[607] Doremus & Tarlock, *supra* note 142, at 340.

B. The National Research Council Report

In 2001, the Departments of Interior and Commerce commissioned a National Research Council ("NRC") Committee to review the quality of the science underlying the biological opinions ("BOs") drafted by the wildlife agencies regarding Klamath Basin species.[608] After a comprehensive review of the wildlife agencies' scientific endeavors, the Committee concluded that there was "substantial scientific support for all recommendations made by the two listing agencies for the benefit of the endangered and threatened species, *except for recommendations requiring more stringent controls over water levels in the Upper Klamath Lake and flows at Iron Gate Dam.*"[609]

The Committee's conclusion that scientific support for the recommended lake and flow levels was insubstantial directly reflects the types of uncertainties that typify ecosystem science. Data gaps and biological uncertainties complicated the wildlife agencies' assessments of exactly what habitat characteristics were necessary for the fish species' survival.[610] Since fish need a minimum quantity[611] of water to survive, setting minimum lake levels and river flows seemed like a good starting point for regulation.[612] The NRC Committee, however, said that regardless of the logic of the wildlife agencies' reasoning, given the current state of knowledge, no "substantial scientific support" for the minimum lake and river levels existed.[613]

Responses to the NRC Report varied dramatically.[614] Newspaper reports sharply criticized the wildlife agencies for having needlessly harmed

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[608] The NRC is the research arm of the National Academy of Sciences. NRC Final Report, *supra* note 142, at iii. The committee was named the Committee on Endangered and Threatened Fishes in the Klamath River Basin. *Id* at 2.

[609] *Id.* at 3 (emphasis added). The Committee further states that

> [t]here is no evidence of a causal connection between water level and water quality or [sucker] mortality over the broad operating range in the 1990s, the period for which the most complete data are available for Upper Klamath Lake. Neither mass mortality of fish nor extremes of poor water quality shows any detectable relationship to water level. Thus, despite theoretical speculations, *there is no basis in evidence* for optimism that manipulation of water levels has the potential to moderate mass mortality of suckers in Upper Klamath Lake.

Id. at 6 (emphasis added). With respect to the coho, the Committee states that "high flow could be favorable to the migrating smolts, although this has not been demonstrated for the Klamath River." *Id.* at 7–8. The Committee further finds that increased water temperature (which could result directly from reduced flows) is probably the most important cause of impairment to the salmon, but finds that "augmentation water must be derived from the surface layer of Iron Gate Reservoir, which is very warm in summer," and thus augmenting flows might not appreciably reduce water temperatures. *Id.*

[610] Doremus, *supra* note 62, at 437.

[611] The quantity measure impacts water quality as well, in terms of temperature, sediment load, chemical contaminant concentrations, and other quality measures. *See, e.g.*, Doremus & Tarlock, *supra* note 142, at 310.

[612] Doremus, *supra* note 62, at 437.

[613] NRC Final Report, *supra* note 142 at 3–4.

[614] *See* Doremus & Tarlock, *supra* note 142, at 326. For a discussion of the NRC

farmers. Fishery biologists argued that the Report should not be considered the definitive scientific statement on the ecological needs of the fish.[615] The wildlife agencies backpedaled, issuing new BOs with relaxed requirements. The Bureau issued a new ten-year operating plan relying on the findings of the NRC Report.[616] Perhaps the only consensus that could be reached regarding the NRC Report was that it brought into sharp focus the need to define more clearly the role that science should play where the ESA, water law, and politics collide.

1. The Scientific Fallout

While the NRC Report undoubtedly dealt a blow to species protection efforts, its impact on the science underlying ESA decisions is somewhat limited. To understand why, it is important to consider exactly what the NRC Committee was charged with doing. The Committee was *not* charged with determining whether the wildlife agencies complied with the ESA's best available science mandate. The ESA standard is a legal standard, which is qualitatively different from the rigorous scientific scrutiny that the NRC Committee applied to the science underlying the wildlife agencies' management actions.[617] The courts have held that wildlife agencies must rely on the best data available, not the best data possible.[618] Thus, as long as agency biologists evaluate the available data, acknowledge any uncertainties, and explain why they decided to proceed in the way they did, their professional judgment should continue to be accorded deference in the courtroom.

Rather than applying this deferential approach, the NRC Committee analyzed the wildlife agencies' Klamath Basin management decisions using a scientific method/sound science sort of inquiry. As discussed above, the burden of proof under such a method is quite high and is thus generally inappropriate in the species conservation context. Fortunately for imperiled species, a scientific method/sound science approach is not what is currently required by the ESA. The ESA's best available science mandate al-

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Committee's deliberation process and final report from the perspective of one of the Committee members, see Ruhl, *supra* note 6, at 584–603.

[615] Doremus & Tarlock, *supra* note 142, at 326–27; Robert F. Service, *"Combat Biology" on the Klamath*, 300 SCIENCE 36, 36 (2003) (noting that the NRC report has sparked a "muted outcry" among fishery biologists, who "contend that the report's analyses were simplistic, its conclusions overdrawn, and . . . that the report has undermined the credibility of much of the science being done in the region if not fueled an outright anti-science sentiment.").

[616] Doremus & Tarlock, *supra* note 142, at 326. For a more thorough discussion on the Bureau's new long-term operations plan, see *id.* at 327–28.

[617] *See also* Ruhl, *supra* note 6, at 587 (noting that the Committee's use of the scientific method in the Klamath Basin context made for a more demanding review than that required by the ESA's Professional Judgment model).

[618] *See Lujan*, 891 F.2d at 933; S.W. Ctr. for Biological Diversity v. Norton, 2002 WL 1733618 at *9 (D.D.C July 29, 2002).

lows wildlife agencies to make management decisions even in the face of uncertainty as long as the wildlife agency makes an informed professional judgment. Given the differing standards applied by the NRC Committee and required by the ESA, the practical effect of the NRC Report theoretically should be limited.[619]

The wildlife agencies seemed to recognize the limited implications of the NRC Report and continued to defend the science upon which they relied in drafting their BOs.[620] NOAA Fisheries acknowledged the existing data gaps regarding coho biology but also pointed out that the data recommended by the NRC Committee would take upwards of ten years to gather.[621] Given the emergency room mentality of the ESA and given that the salmon were teetering on the brink of extinction, NOAA Fisheries argued that its "cautious approach" was proper, at least while the requisite data were being gathered.[622]

In its revised BO, the FWS maintained its position that low water levels would jeopardize the sucker species.[623] The agency went out of its way to try to explain the scientific reasoning behind its recommendations. It first explained that shallower water corresponds to higher contaminant concentrations and that reduced water quality increases the probability of localized fish kills.[624] The agency also "went to great pains to explain how water depth could affect dissolved oxygen, pH, nutrient availability and algal blooms, and set out evidence supporting those connections."[625] It then explained that lower water levels would also limit spawning habitat and reduce access to high quality refugia for larvae, juvenile, and adult fish.[626]

While the ramifications of the NRC Report within the scientific community may be limited, the problems the wildlife agencies encountered in the Klamath Basin clearly demonstrate the pitfalls of the ESA's crisis mentality and species-specific focus. This type of approach does not promote comprehensive, ecosystem-based decision-making; rather, it allows political agendas and media manipulation of scientific reports to color public opinion and to potentially reign over species survival.[627] Thus, while

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[619] The NRC Report did, however, breathe new life into ESA opponents' sound science initiatives. In the wake of the Klamath crisis, The Sound Science for Endangered Species Act of 2002 was brought before Congress. *See* Doremus & Tarlock, *supra* note 142, at 333. *See also* Part IV.A.2.c, *infra*.

[620] Doremus & Tarlock, *supra* note 142, at 328.

[621] *Id.* at 330.

[622] It referred to the ESA consultation handbook, which directs the agencies to "provide the benefit of the doubt to the species concerned with respect to such gaps in the information base." *Id.* (citing NAT'L MARINE FISHERIES SERV., BIOLOGICAL OPINION: KLAMATH PROJECT OPERATIONS 7 (2002), *available at* http://swr.nmfs.noaa.gov/psd/klamath/KpopBO2002finalMay31.PDF).

[623] Doremus & Tarlock, *supra* note 142, at 328.

[624] *Id.*

[625] *Id.* at 329.

[626] *Id.* at 328–29.

[627] *See* NRC FINAL REPORT, *supra* note 142, at 316 ("The ESA's species-specific focus is in itself an inadequate basis of ecosystem-wide decision-making in the Klamath River

the scientific fallout of the NRC report is limited, the political fallout is far more alarming.

2. The Political Fallout

It seems plausible that the NRC's initial charge was specifically worded in such a way that the conclusion regarding flow and lake levels was foregone (and in accordance with the Administration's desires).[628] By wording its conclusion in terms of "sound science" rather than "alternative interpretations of the available science," the NRC may have been reacting to a politically biased process.[629] Regardless of political *intent*, the palpable *effect* of the Report's focus on the "soundness" of the science underlying the wildlife agencies' recommendations has been public misunderstanding and mistrust.[630]

After the Report was published, numerous forces came together to tear down the wildlife agencies' credibility. Attention-grabbing headlines screamed of agency scientists' apparent ineptitudes.[631] Congressmen condemned "sloppy science [that] ruins regional economies and personal livelihoods."[632] Anti-ESA forces spun stories of "powerful regulators run-

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basin."); *id.* at 329; Doremus & Tarlock, *supra* note 142, at 288. Professors Doremus and Tarlock call the ESA "basically a development permit program, rather than a comprehensive biodiversity program." *Id.* at 341.

[628] Even irrigators, who had reason to be pleased with the NRC's findings, commented that the Interim Report "appear[ed] to be more a political assessment instead of an objective look at the science." *Klamath Basin Report Riddled With Errors, OSU Researchers Say*, U.S. WATER NEWS ONLINE, Nov. 2002, http://www.uswaternews.com/archives/arcrights/2klabas11.html (on file with the Harvard Environmental Law Review) (quoting Dan Keppen of the Klamath Water Users Association, a nonprofit corporation that has long represented ranchers and farmers that use the Klamath Irrigation Project).

[629] Michael S. Cooperman & Douglas F. Markle, *The Endangered Species Act and the National Resource Council's Interim Judgment in Klamath Basin*, 28 FISHERIES 10, 14, 17 (2003), *available at* http://www.fisheries.org/html/fisheries/F2803 /F2803p10-19.pdf.

[630] In a report criticizing the NRC's Interim Report, a fisheries biologist and graduate student from Oregon State University commented that the Report "has not helped the public's understanding of science. Rather, its primary impact has been to increase resentment of resource laws and agencies." *Id.* at 17. *See also* Marcilynn A. Burke, *Klamath Farmers and Cappuccino Cowboys: The Rhetoric of the Endangered Species Act and Why It (Still) Matters*, 14 DUKE ENVTL. L. & POL'Y F. 441, 513 (2004) (citing Wendy Wagner, *The "Bad Science" Fiction: Reclaiming the Debate Over the Role of Science in Public Health and Environmental Regulation*, 66 LAW & CONTEMP. PROBS. 63, 109–32 (2003)).

[631] University of Houston assistant law professor Marcilynn A. Burke has dubbed these stories "tales from the regulatory crypt." Burke, *supra* note 630, at 445 (quoting statement of Rep. Smith). *See also id.* at 444:

> Recognizing the political sway of well-told, oft-repeated stories, those members of Congress along with private property rights activists called for reform on behalf of small private property owners who allegedly were having their rights trampled upon and their financial lives ruined by overzealous regulators. These 'horror stories' illustrat[ed] the Act's devastating consequences.

[632] Cooperman & Markle, *supra* note 629, at 11 (quoting Rep. Hansen, Chairman, House Comm. on Res.).

ning roughshod over landowners whose entire financial and emotional lives are closely tied to their land." Thus, it is hardly surprising that the public began to think of the ESA as somehow dysfunctional.[633] And as noted by Boston College law professor Zygmunt Plater, it is this public perception that "ultimately . . . is the most important and determinative factor [of a case]. What the public knows (or, significantly, does not know) of the case, ultimately determines outcomes."[634]

And what the public knows about the Klamath Basin case comes not from stories parsing the differences between scientific and judicial standards of proof, but from agricultural interests that cite the NRC Report as proof of the "junk science" behind the wildlife agencies' ESA decisions.[635] It comes from "sound science" proponents who use the NRC Report as a trump card in the "burgeoning legal movement that threatens the most important environmental law in the country."[636] And anti-ESA forces are now taking full advantage of the public's misperception that the wildlife agencies are using unreliable and shoddy science to implement the ESA in their renewed attempts to reform the Act.[637]

Thus, the political and rhetorical dialogue surrounding the NRC Report is not harmless commentary or benign rhetoric but is "seductively powerful" and has had a very real, lasting impact on the public's perception of scientific integrity and the ESA.[638] The fallout from the NRC Re-

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[633] Burke, *supra* note 630, at 455 (quoting Holly Doremus, *The Rhetoric and Reality of Nature Protection: Toward a New Discourse*, 57 WASH. & LEE L. REV. 11, 43 (2000)); *id.* at 458.

[634] *Id.* at 479 (citing Zygmunt J. B. Plater, *Law and the Fourth Estate: Endangered Nature, the Press, and the Dicey Game of Democratic Government*, 32 ENVTL. L. 1, 2 (2002)).

[635] Chris Mooney, *Sucker Punch: How Conservatives Are Trying To Use a Conflict Over Obscure Fish To Gut the Science Behind the Endangered Species Act*, LEGAL AFF., May-June 2004, at 23, 24.

[636] *Id.* at 23, 25. *See also id.* at 25 ("[T]he Klamath had become Exhibit A in the case for ESA reform.").

[637] *See* Part IV.A.2.e, *infra* (discussing TESRA, Rep. Pombo's September, 2005 attempt to amend the ESA). Their goals include strengthening scientific reviews, providing incentives for private landowners, and increasing state involvement. *Id. See also* Burke, *supra* note 630, at 507. Powerful forces within the government are taking advantage of this misperception as well. For example, Interior Secretary Gale Norton has decried the scientific "weaknesses" revealed by the Report and remarked that it "will affect our decision-making process for this year and future years." Mooney, *supra* note 635, at 25; Cooperman & Markle, *supra* note 629, at 17 (citing C. Souza, *NAS Report Backs Farmers in Klamath*, NEWSL. OF THE CALIFORNIA FARM BUREAU FED'N, Feb. 6, 2002).

[638] Burke, *supra* note 630, at 443. Professor Burke describes this rhetoric as follows:

> Political rhetoric—through the use of stories and catchphrases—frames debates and influences outcomes. It is directed towards the various branches of government as well as the public and is presented in various formats, including Congressional testimony, press releases, newspaper and magazine articles, and television and radio news broadcasts. Political rhetoric works well with what Zygmunt Plater calls "infotainment," that is, "the broadcast news departments' perceived need to be attractive and engaging to their desired audience by producing quick and catchy news segments." It is captivating, enduring, and powerful. Significantly, the law responds to political rhetoric formally through legislation and regulation as well as infor-

port has tended to delegitimize the wildlife agencies' scientific work ethic, undermined public support for endangered species protection, and provided fuel for proposed legislative reform efforts.[639] In fact, the Report has proven such a successful means for achieving partisan ends that Representative Pombo committed to using mechanisms like the NRC Report to "'break [the ESA] down' one piece at a time."[640] But with his newly introduced TESRA legislation, he may not need to take such a gradual approach: he may be able to topple the ESA with one fell swoop.

What is perhaps most distressing about the situation is the extent to which it appears symptomatic of an administrative agenda of manipulating science to achieve partisan ends. Several sources support the idea that just such an agenda guided the Administration's handling of the Klamath Basin situation. One such source is former NOAA Fisheries scientist Michael Kelly. Kelly resigned after blowing the whistle on the Administration's suppression of scientific evidence in the Klamath Basin situation.[641] Specifically, Kelly pointed to the Administration's dismissal of wildlife agency scientists' concerns as expressed in the BOs as well as its suppression of a U.S. Geological Survey Economic Report[642] which concluded that restoring river flows would generate from six to thirty times the economic benefits of continued agricultural diversion.[643] This selective suppression and dissemination of evidence is unfortunate and typical of the Bush Administration's handling of scientific matters.[644] As one commentator noted,

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mally through discretionary acts of the Executive Branch.

Id.

[639] E-mail from Leshy to Carden, *supra* note 551; Burke, *supra* note 630, at 443.

[640] Burke, *supra* note 630, at 477.

[641] Patrick Parenteau, *Anything Industry Wants: Environmental Policy Under Bush II*, 14 Duke Envtl. L. & Pol'y F. 363, 384 (2004). Said Kelly, "My particular case is . . . symptomatic of this agency's failure to correctly apply science and caution to its decisions and public pronouncements . . . . I speak for many of my fellow biologists who are embarrassed and disgusted by the agency's apparent misuse of science." *Klamath Whistleblower Leaves Fisheries Service*, Env't News Service, May 21, 2004, http://www.ens-newswire.com/ens/may2004/2004-05-21-096.asp (on file with the Harvard Environmental Law Review).

[642] Aaron J. Douglas & Andrew Sleeper, Estimating Recreation Trip Related Benefits for the Klamath River Basin with TCM and Contingent Use Data (2002), *available at* http://www.earthjustice.org/news/documents/klamath%20recreation.pdf.

[643] Parenteau, *supra* note 641, at 393. The Geological Survey's report was ultimately leaked to the Wall Street Journal. Press Release, Earthjustice, Suppressed Government Report Shows Klamath Irrigation A Bad Investment (Nov. 1, 2002), http://www.earthjustice.org/news/display.html?ID=466 (on file with the Harvard Environmental Law Review). The six times figure comes from Parenteau, *supra* note 641, at 393; the thirty times figure comes from Earthjustice, *supra*.

[644] Another recent example of the Bush Administration's suppression of science occurred in the context of mercury emissions. In mid-March 2005, the Environmental Protection Agency promulgated a rule to limit mercury emissions from U.S. power plants. EPA officials defended the rule by stating that more stringent levels were not justified by a cost-benefit analysis. However, a Harvard University study paid for, co-authored, and peer-reviewed by EPA scientists estimated health benefits 100 times greater than those identified by EPA. Since the report would have undermined the proposed rule, top EPA officials ordered the study's finding stripped from public documents. Shankar Vedantam, *New EPA*

President Bush's response to science tends to be, "[H]ear no science, see no science, delete all science."[645] Such conscious, selective behavior leads to "grossly and irrationally misinformed" decisions, which in turn lead us to sacrifice environmental goods such as species protection in the name of an "imagined or fabricated crisis."[646]

When those in power fabricate economic crises to achieve partisan ends and take advantage of the public misperceptions that result, the ecological consequences—as demonstrated by the Klamath Basin situation—can be catastrophic for endangered species. The ESA has reached a crossroads, and it is imperative that those concerned with species protection take charge of the Act's revision process.[647] At the end of the day, let us hope that the fallout from the NRC Report and the introduction of the TESRA legislation in Congress jumpstart efforts among natural resource professionals to begin formulating a new approach to species protection that is more holistic, more adaptive, and ultimately, more effective.

VI. Conclusion

The Klamath Basin crisis brings into sharp focus the need for a new approach to conservation and natural resource management. The experience illustrates the havoc that can be wreaked by our refusal to get out of the E.R., by our hesitancy to take a more proactive approach to species conservation and ecosystem protection. It epitomizes the lose-lose situations we find ourselves in when our decision-making processes fail to account for perceived human needs. The Klamath River Basin situation shows, in stark relief, why our current piecemeal approach to environmental decision-making—treating water allocation, human needs, and species protection as discrete and separable issues—is both ecologically unsound, and politically untenable.[648]

To achieve an ecologically successful and politically viable species protection program, we must approach conservation issues from a new angle. First and foremost, our environmental legislation must realize a fusion of environmental science and environmental law. While science must remain the cornerstone of any sincere conservation effort, legislators must

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Mercury Rule Omits Conflicting Data; *Study Called Stricter Limits Cost-Effective*, Wash. Post, Mar. 22, 2005, at A1.

[645] Burke, *supra* note 630, at 512 (citing Derrick Z. Jackson, *Bush Doesn't Hear "Sound Science*,*"* Seattle Post-Intelligencer, Aug. 5, 2003, at B7).

[646] Burke, *supra* note 630, at 458 (citing Thomas Michael Power & Richard N. Barrett, Post-Cowboy Economics: Pay and Prosperity in the New American West 126 (2001)).

[647] Just this month The Wildlife Society, a professional association that certifies wildlife biologists and disseminates peer-reviewed publications, announced it is currently "finalizing a technical report that will identify problems limiting the successful implementation of the ESA and recommend practical solutions for improving its effectiveness for wildlife conservation." The Wildlife Society, *supra* note 369, at 5.

[648] *See* Doremus & Tarlock, *supra* note 142, at 280.

recognize that science cannot provide us with the answers to every conservation conundrum. Science cannot answer value-laden questions about how much protection we should give species or how much ecosystem destruction we are willing to tolerate. Furthermore, even with respect to scientific questions, our knowledge is uncertain and always evolving. Natural resource professionals faced with species-protection problems must be able to act on incomplete knowledge. This reality must be reflected in the text of environmental legislation.

Scientists can help ensure that environmental legislation reflects scientific reality by becoming more active in the conservation policy-making process. By becoming involved in the policy-making process, scientists can serve as a kind of "instruction manual," informing lawmakers on how best to incorporate science into conservation law. In this way, scientists can help ensure that statutory mandates are practically feasible.

Scientists and lawmakers should also band together in a sincere science education campaign. This educative effort needs to occur on several levels: in our schools, in our communities, in Congress, and in the courts. If people become better educated in the fundamentals of science, they can participate more effectively in the conservation debate. Further, an educated public can better stymie politicians' efforts to subvert or manipulate science for partisan ends. An educated public is more likely to see "sound science" initiatives like the TESRA for what they are: efforts to undermine our commitment to species conservation and biodiversity protection.

If we, as a nation, remain committed to protecting species and biodiversity, we must act now to prevent unnecessary species extinction and ecosystem destruction. We must begin to shape a more comprehensive, flexible, interdisciplinary, ecosystem-based conservation scheme.[649]

The future of the Klamath—and of ecosystems across the country—depends on an honest, integrative approach.

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> [T]he absence of an integrated, evolving management plan connected to monitoring, research, review, and periodic readjustment of management actions will hamper progress [in the Klamath basin] in the future. Although agencies must meet the requirements of the ESA, many actions that could benefit the listed species can also be justified from the viewpoint of ecosystem management favorable to numerous other species, some of which are perilously close to listing, and to ecosystem functions that have great practical value.

NRC Final Report, *supra* note 142, at 9–10. Others in the scientific community have also advocated such an approach: "Scientists and managers engaged in salmon recovery increasingly are realizing the importance of whole-life cycle, whole-ecosystem approaches to identifying significant threats to salmon populations." Ruckelshaus et al., *supra* note 12, at 690. The NRC Committee suggested that, under the current ESA framework, scientists and managers could use Section 7(a)(1) as a means through which "the agencies could establish and implement a comprehensive, flexible, multiagency consultation process . . . to promote conservation of the listed species." *Id.* at 323.