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The Meanings of Biological Integrity, Diversity, and Environmental Health

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ABSTRACT

This article extracts from the legislative mandate to "ensure that the biological integrity, diversity, and environmental health of the [Refuge] System are maintained," a range of meanings that reflects scientific and legislative trends in conservation. The standard modes of statutory interpretation yield meanings that largely support the 2001 Fish and Wildlife Service policy delineating three distinct yet overlapping categories. The analysis reveals three insights applicable to other areas of environmental law. First, although diversity and health emphasize important aspects of nature protection, integrity is becoming the umbrella concept that encompasses the needs of well functioning landscapes. Second, the effectiveness of an organic mandate hinges on agency implementation, and the 2001 policy – though a laudable start – does not adequately establish benchmarks to measure compliance. Third, broad spatial and temporal scales now frame nature protection. The mandate looks beyond individual refuge boundaries to the context of a watershed, region, or the entire federal land system, in addressing the dynamic variation in ecological processes.

I. INTRODUCTION

From its beginning, a little over a century ago, the national wildlife refuge system has represented the cutting edge of scientific nature protection. In the early 1900s, the refuges delineated the havens from hunting that were expected to sustain wild birds and large game populations. President Theodore Roosevelt, a naturalist in his own right, pioneered the refuge as sanctuary with his executive invention of

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wildlife reserves.[1] At a time when the national parks were still focused on geological curiosities and monumental wonders, the refuges were oriented toward biology. The vast majority of these early refuges were managed by the Bureau of Biological Survey, then a science agency in the Department of Agriculture headed by the prominent biologist C. Hart Merriam.[2] Despite the Biological Survey's research agenda, refuge protection was still a zoo-like affair where animals were protected behind clear boundaries.

In the 1930s, after ornithologists had discovered the linear flyways that transected the country, wildlife refuges served as stepping-stones along the migratory paths that carried birds from their breeding grounds to their wintering grounds. When Aldo Leopold published the first textbook of game management in 1933, he wrote that a refuge "is an integral part of a larger area."[3] Leopold's definition illustrates that while national park protection still looked inward from the units' borders, refuges were beginning to look outward.

In the 1960s, as extinction concerns rose to prominence, the refuge system became the public land partner to species recovery efforts. By this time, early public support for and congressional interest in birds, fish, and game had expanded to a wider range of imperiled animals. From 1966 until 1997, the legislative charter for the refuge system derived from a statute whose purpose was to protect native wildlife threatened with extinction.[4] In 1968, the Leopold committee, named for its scientist chair, Aldo's son, issued its recommendations for the future of the refuge system. The committee applied an emerging, science-based approach to nature protection in calling for the comprehensive maintenance of "natural ecosystem[s]."[5]

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1. Exec. Order of Mar. 14, 1903, microformed on Presidential Executive Orders and Proclamations, Fiche 1903-33-1 (Cong. Info. Serv.).

2. DONALD WORSTER, NATURE'S ECONOMY: A HISTORY OF ECOLOGICAL IDEAS 262-63 (2d ed. 1994) (noting that Merriam created the "life zones" idea and was an expert on the food habits of birds). Merriam turned the research focus of the Bureau of Biological Survey toward the geographic distribution of wildlife. *Id.* The Secretary of the Interior now manages the refuges through the U.S. Fish and Wildlife Service.

3. ALDO LEOPOLD, GAME MANAGEMENT 195 (Charles Scribner's Sons 1948) (1933).

4. "An Act to Provide for the Conservation...of Native Species...Threatened with Extinction," Pub. L. No. 89-669, 80 Stat. 926.

5. A. Starker Leopold et al., *The National Wildlife Refuge System: Report of the Advisory Committee on Wildlife Management, in* DEPARTMENT OF THE INTERIOR DRAFT ENVIRONMENTAL STATEMENT: OPERATION OF THE NATIONAL WILDLIFE REFUGE SYSTEM W-4 (U.S. Fish & Wildlife Serv., Dept. of the Interior ed., 1975). The committee report accompanying the 1997 Refuge Improvement Act endorsed the Leopold Committee report's admonition that the refuge system should "stand as a monument to the science and practice of wildlife management." H.R. REP. NO. 105-106, at 9 (1997), *reprinted in* 1997 U.S.C.C.A.N. 1798-5, 1798-13.

President Clinton's 1996 executive order providing systemic guidance for refuge management manifested the lessons of conservation biology in the broad ecological mission "to preserve a national network of lands and waters for the conservation and management of fish, wildlife, and plant resources."[6] The following year, Congress adopted this same, modern conception of nature protection, which includes plants as well as animals. The 1997 National Wildlife Refuge System Improvement Act (Improvement Act) adds to the "network of lands and waters" mission by specifying that the goal of the refuge system is "to sustain and, where appropriate, restore and enhance, healthy populations of fish, wildlife, and plants utilizing...methods and procedures associated with modern *scientific* resource programs."[7]

The path traced by the evolving mission of the refuges reflects more than just popular conceptions of nature protection. It also reflects the defining role that science has played in establishing the terms of conservation. Beginning with ornithology, expanding to game management, and ultimately encompassing ecology and conservation biology, the national wildlife refuge system has looked to science for its land management goals.

In this article, I posit that a proper understanding of the 1997 statutory mandate to "ensure that the biological integrity, diversity, and environmental health of the [Refuge] System are maintained"[8] must be situated in the context of the prominent role played by scientific conceptions of nature protection. In 1997, Congress sought to build on, not break from, the dynamic tradition of using the refuges to demonstrate and secure scientific protection of nature. I also show how the Improvement Act's use of the integrity-diversity-health terms reflects larger legislative trends in conservation. These trends include a heightened emphasis on integrity as an overarching management goal, increased reliance on agency interpretations to set permissible limits of habitat alteration, and larger temporal and spatial scales of ecological consideration in public land administration.

Of course, determining the meaning of terms in legislation is fundamentally an issue of statutory interpretation. Statutory interpretation covers a spectrum of analyses ranging from a narrow focus on individual words, through a parsing of the surrounding statutory text, to a consideration of legislative history and the broader legal context. Identifying this range of expositions is the subject of

6. Exec. Order No. 12,996, 61 Fed. Reg. 13,647 (Mar. 25, 1996).

7. Pub. L. No. 105-57, 111 Stat. 1252, §§ 3(a)(4), 4(a)(2) (codified as amended at 16 U.S.C. §§ 668dd(a), 668eee(4)) (emphasis added).

8. 16 U.S.C. § 668dd(a)(4)(B) (2000).

section II of this article. The following sections (III-VI) explore the meanings of integrity, diversity, and health through each of the modes of statutory interpretation, from the narrowest to the broadest.

Regardless of the type of statutory interpretation employed, the mandate to maintain biological integrity, diversity, and environmental health is the most recent, and the most ecologically informed, of any legislative criterion for public land management. Congress clearly intended that the refuges should protect nature in accordance with the latest scientific understanding. This is a familiar role for the refuge system, which historically relied more on science for defining its nature conservation goals than do the other dominant-use public land systems, such as the national park system or the national wilderness preservation system.

At the same time, the integrity-diversity-health mandate is the greatest challenge faced by the U.S. Fish and Wildlife Service (FWS or the Service) in meeting its mission. First, understanding and unpacking the concepts of biological integrity, diversity, and environmental health will require ardent commitment. Second, the new substantive management criterion requires the Service to stretch outward in coordinating conservation efforts far beyond the U.S. public land tradition and the agency's comfort zone. It is not entirely clear how the crazy-quilt refuge system can pull together and implement a strategy to fulfill the 1997 challenge. However, this is what the statute requires. And, the science indicates that effective, long-term nature protection demands it.

II. STATUTORY INTERPRETATION

An examination of the meaning of the 1997 mandate to maintain biological integrity, diversity, and environmental health must be guided by the legal principles of statutory interpretation. The meanings of these terms are not self-evident and some interpretation is an inescapable aspect of implementing the law. Similar—even identical—terms will trigger different actions depending on the era in which the terms were deployed. For example, the conservation mandate of the Forest Service, as laid out by Gifford Pinchot in 1905, binds the agency to devote land to its most productive use for utilitarian benefit.[9] In contrast, the 1973 Endangered Species Act offers a different definition of conservation. It

9. CHARLES F. WILKINSON, CROSSING THE NEXT MERIDIAN: LAND, WATER, AND THE FUTURE OF THE WEST 128 (1992) (quoting the letter to Gifford Pinchot (Pinchot Letter) from Secretary of Agriculture, James Wilson, Feb. 1, 1905). This letter, setting forth the mission of the Forest Service, "remains gospel" to national forest decision makers. *Id.*

requires agencies to use all methods and procedures that are necessary to bring any listed species to recovery.[10] The 1997 National Wildlife Refuge System Improvement Act provides yet a third version of the conservation mandate. It binds the FWS to "sustain and, where appropriate, restore and enhance" healthy populations of plants and animals.[11]

In order to accomplish the 1997 conservation mission, Congress imposed a number of substantive management criteria to guide the Service in administering the refuge system. The most innovative criterion mandates that the Service ensure maintenance of three elements—integrity, diversity, and health. The meaning of these key terms is neither defined in the statute nor self-evident. How should the FWS and the courts choose among various interpretations? Also, how do the terms relate? This article answers these questions by employing the standard techniques of statutory interpretation.

Organic legislation, such as the 1997 Act, is a comprehensive charter for a public land system.[12] The mandate to maintain "biological integrity, diversity, and environmental health" does not contain the hedge phrases so common in public land law that endorse vast agency discretion.[13] The Improvement Act does not soften its command by subordinating it to other organic act objectives, or by limiting its application "where appropriate" or "to the degree practicable."[14] The unequivocal quality of the command, however, masks a lack of clarity in the terms of the mandate. Nowhere does the statute define the meaning of the phrase "biological integrity, diversity, and environmental health" or its constituent elements.

The legislative history likewise does little to clarify the meaning of the mandate. Even the science and policy literature that discusses these terms fails to produce a uniform or even consensus definition that authoritatively sets out the measures of biological integrity, diversity, and environmental health. The terms are used differently in different applications. Because the statute uses them for legal purposes, certain canons of statutory construction bear on an accurate comprehension of their meaning. Still, even the strictest of legislative interpretations leaves to the FWS broad latitude to define the content of its substantive management criterion.

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10. 16 U.S.C. §§ 1531-1532 (2000).

11. *See id.* § 668ee(4).

12. Robert L. Fischman, *The National Wildlife Refuge System and the Hallmarks of Modern Organic Legislation*, 29 ECOLOGY L.Q. 457 (2002).

13. *See* 16 U.S.C. § 668dd(a)(4)(B) (2000).

14. *Cf. id.* § 1604(g)(3)(B) (National Forest Management Act ecological mandate).

In statutory interpretation, no set rule provides a certain answer. Instead, four modes of analysis will be relevant to the answer. The following sections address each of the four modes in rough order from the narrowest sort of analysis to the most broad.[15] The narrowest approach, in section III, focuses on the individual words in isolation. Each word may be defined using its ordinary meaning, as derived from dictionaries, or its specialized meaning, as derived from academic or resource management literature. The next approach, described in section IV, analyzes the internal statutory context of the terms as they relate to each other within the 1997 Act. This type of textual analysis looks to the surrounding words and phrases in the law to provide meaning. Section V steps out of the bounds of the enacted statute's text to consider how the legislative history of the 1997 Refuge Improvement Act bears on the meaning of integrity-diversity-health. Finally, section VI examines the broad legal context to compare the way in which Congress has used the words integrity, diversity, and health through time and across different environmental subjects.

III. INDIVIDUAL WORDS

As Judge Learned Hand noted 50 years ago, an examination of the definitions of individual words is the most reliable starting point in any effort to ascertain the meaning of a legal text.[16] The most common source of word definitions is, of course, an English language dictionary. However, general dictionaries provide ordinary definitions that fail to capture the way in which terms such as integrity, diversity, and health are used by scientists and resource managers.

Judge Hand cautioned against confusing starting points with ending points in statutory interpretation. He wrote that "it is one of the surest indexes of a mature and developed jurisprudence not to make a fortress out of the dictionary; but to remember that statutes always have some purpose or object to accomplish, whose sympathetic and imaginative discovery is the surest guide to their meaning."[17] The express purpose of the Improvement Act is to provide a nature protection mission for the refuge system. Moreover, Congress situated the management criteria in the scientific management tradition of the FWS. Therefore, after describing the ordinary definitions of the terms,

15. *See* William N. Eskridge, Jr., & Philip P. Frickey, *Statutory Interpretation as Practical Reasoning*, 42 STAN. L. REV. 321, 345-62 (1990).

16. Cabell v. Markham, 148 F.2d 737, 739 (2d Cir. 1945).

17. *Id.*

this section will explore the specialized meanings of integrity, diversity, and health in the technical literature.

A. Ordinary Definitions

The ordinary definitions of the terms will play a role in authoritative interpretations. Increasingly in the past 20 years, courts have turned to dictionaries to make sense of statutory language. The strict textualists, especially, endorse the use of dictionaries to understand the meaning of statutes.[18] Indeed, the Supreme Court has used dictionaries more frequently in recent years.[19]

However, in most situations where interpreters, such as courts, turn to dictionaries, the words are common and without associated scientific literatures. For instance, the debate over the meaning of "harm" in the definition of "take" (a prohibited act under the Endangered Species Act[20]) involves a word with an everyday application. It is plausible that a dictionary would be helpful in understanding the congressional intent of the "harm" element of "take." This was the position of both Justice Stevens' majority opinion and Justice Scalia's dissent in the *Sweet Home* case upholding the FWS regulatory definition of harm.[21]

In contrast, the definitions of biological integrity and diversity do not so readily lend themselves to illumination from the dictionary. That is not to say that the dictionary is no help at all. Indeed, much of the technical literature on the terms "biological integrity, diversity, and environmental health" uses ordinary, generalist dictionary meanings as starting points for more specialized analysis.[22]

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18. *See* Antonin Scalia, *Common-Law Courts in a Civil Law System: The Role of United States Federal Courts in Interpreting the Constitutional Law, in* A MATTER OF INTERPRETATION: FEDERAL COURTS AND THE LAW (Amy Gutmann ed., 1997). Only *some* dictionaries, though, meet Justice Scalia's exacting standards. *Cf.* MCI v. AT&T, 512 U.S. 218, 228 n.3 (1994).

19. WILLLIAM N. ESKRIDGE ET AL., LEGISLATION AND STATUTORY INTERPRETATION 252 (2000); *see generally* Ellen P. Aprill, *The Law of the Word: Dictionary Shopping in the Supreme Court*, 30 ARIZ. ST. L.J. 275 (1998); Note: *Looking It Up: Dictionaries and Statutory Interpretation*, 107 HARV. L. REV. 1437 (1994).

20. 16 U.S.C. § 1538 (2000).

21. Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or., 515 U.S. 687, 697, 717, 719 (1995) [hereinafter *Sweet Home*].

22. *E.g.*, Peter Miller & William E. Rees, *Introduction, in* ECOLOGICAL INTEGRITY: INTEGRATING ENVIRONMENT, CONSERVATION, AND HEALTH 3, 10 (David Pimentel et al. eds., 2000); Benjamin D. Haskell et al., *What Is Ecosystem Health and Why Should We Worry About It?, in* ECOSYSTEM HEALTH: NEW GOALS FOR ENVIRONMENTAL MANAGEMENT 5-6 (Robert Costanza et al. eds., 1992).

"Environmental health" is more rooted in the ordinary meaning of its words than the other terms. The standard *Webster's Third New International Dictionary* defines health to mean "performing all functions normally or properly; soundness; vitality."[23] The dictionary defines environment to mean surrounding conditions, or "the whole complex of climatic, edaphic, and biotic factors that act upon an organism or ecological community."[24] Of all the dictionary definitions of the elements of "biological integrity, diversity, and environmental health," this definition of environmental is the most technical and directly relevant to the application of the term in the Act. Interestingly, its inclusion of biotic factors puts it at odds with the Service Policy.[25]

The other terms' ordinary meanings certainly do suggest the more technical definitions in the scholarly literature, but they are not very precise. Biology relates to the science of life, ecology, or the "plant and animal life of a particular region."[26] Integrity is an "unimpaired, unmarred condition."[27] Diversity is variety or points of difference.[28]

B. Specialized Meanings

The active scientific discourse about the meaning of integrity, diversity, and health ought to figure into a proper interpretation of the 1997 Act. Congress continued its historic tradition of science-based conservation in the Act, and therefore must have intended the ecological disciplines to influence refuge administration. A vast technical literature discusses the specialized meaning of integrity, diversity, and health for the purposes of resource management. This literature is relevant because the Act uses the terms as substantive resource management criteria.[29] The technical literature reveals several different ways of understanding

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23. WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY OF THE ENGLISH LANGUAGE UNABRIDGED 1043 (3d ed. 1993) [hereinafter WEBSTER'S DICTIONARY]. This dictionary has a descriptive orientation and is more likely to capture how legislators thought about words rather than to serve as a prescriptive reference. Paradoxically, it is this very descriptive character of WEBSTER'S DICTIONARY to which Justice Scalia objects. WILLIAM N. ESKRIDGE, JR., LEGISLATION AND STATUTORY INTERPRETATION 252–53 (2000).

24. WEBSTER'S DICTIONARY, *supra* note 23, at 760.

25. The policy defines environmental health as the "composition, structure, and functioning of soil, water, air, and other *abiotic* features comparable with historic conditions." Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System, 66 Fed. Reg. 3810, 3818 (Jan. 16, 2001) (emphasis added).

26. WEBSTER'S DICTIONARY, *supra* note 23, at 218.

27. *Id.* at 1174.

28. *Id.* at 663.

29. *See* Fischman, *supra* note 12, at 511–12, 563–71 (2002).

the terms integrity, diversity, and health. This subsection discusses the various approaches so that the subsequent review of laws adopting the terms, in section VI, can test to see which, if any, models fit.

The Act grants the implementing agency great discretion in establishing the meanings and measures of the terms, as do most other laws that employ variations on integrity, diversity, and health.[30] Science has only recently made a serious examination of biological integrity and diversity. Environmental health has seen even less use as a scientifically based benchmark. Courts under these circumstances hold agency interpretations to lax standards. For example, in *Sierra Club v. Marita*, the court upheld a pair of management plans that fragmented habitats, selected indicator species, and altered the abundance of late successional forest types in ways that ran counter to the leading ideas of conservation biology.[31] The *Marita* court held that the Forest Service need not meet the Supreme Court's standards for admission of scientific evidence. Instead, the Service could adopt its own interpretation of the National Forest Management Act's diversity mandate as long as it fulfills the lower arbitrary and capricious standard.[32] Unlike litigants in private suits, who must surmount difficult hurdles in order to submit scientific evidence, agencies only have to show that they considered the relevant factors in adopting a particular interpretation.[33]

The greatest challenge in describing the scientific usage of the integrity-diversity-health terms is the broad spectrum of their application. Even the most specific term, "diversity," has meanings that range from the number of species inhabiting an area to the wide scope of variation in all aspects of ecology, embracing both elements (from genes to ecosystems) and life processes.[34] Therefore, some conceptions of

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30. Chevron U.S.A., Inc. v. Natural Res. Def. Council, 467 U.S. 837, 843–45 (1984) (courts will defer to any permissible agency definitions of statutory schemes where Congress does not directly, unambiguously provide precise meanings). *See infra* Part VI.

31. 46 F.3d 606 (7th Cir. 1995).

32. *Id.* at 621; *see* Robert W. Adler, *The Supreme Court and Ecosystems: Environmental Science in Environmental Law*, 27 VT. L. REV. 249, 350 (2003).

33. Adler, *supra* note 32.

34. EDWARD O. WILSON, THE DIVERSITY OF LIFE 393 (1992); NAT'L RESEARCH COUNCIL, PERSPECTIVES ON BIODIVERSITY: VALUING ITS ROLE IN AN EVERCHANGING WORLD 20 (1999); Paul R. Erlich & Simon A. Levin, *Biodiversity: What It Is and Why We Need It*, *in* THE BIODIVERSITY CRISIS: LOSING WHAT COUNTS 46 (Michael J. Novacek ed., 2001). For an example of a narrow definition of biodiversity, see K.H. Redford & S.E. Sanderson, *The Brief Barren Marriage of Biodiversity and Sustainability*, 73 BULL. ECOLOGICAL SOC'Y AM. 36 (1992) (biodiversity as species diversity). For an example of a broad definition, see Reed F. Noss, *Indicators for Monitoring Biodiversity: A Hierarchical Approach*, 4 CONSERVATION BIOLOGY 356–57 (1990) (biodiversity as existing on several organizational levels from genes to whole ecosystems).

diversity are simple measures of larger ecological characteristics, such as integrity, while other conceptions of diversity encompass the whole range of natural processes that constitute properly functioning ecosystems.[35]

Another difficulty presented by an application of the technical literature is a variation in terminology. The Improvement Act uses the term "diversity," but most sources employ the term "biological diversity" or "biodiversity." Less common but also used is the term "natural variety." It is quite rare to find the unmodified term, "diversity," in the technical literature. Similar, though not as dramatic, is the discrepancy between "biological integrity" and the far more common term, "ecological integrity." Despite the lack of an exact match, I will discuss the scientific meaning of the statutory terms by reference to their closest counterparts in the technical literature.

"Integrity" has a wide range of definitions in the technical literature. One variation, closely associated with aquatic systems and the Clean Water Act, defines biological integrity as "the ability of an environment to support and maintain a biota (both structural and functional performance) comparable to the natural habitats of the region."[36] This definition emphasizes structure and function as measured against a pristine benchmark. It comes closest to the interpretation offered by the 2001 FWS policy and stands as the most influential definition in the scientific literature.[37]

Other approaches build on this measurable definition of integrity to include a bewildering array of attributes, including wildness, regenerative capacity, evolutionary processes, and organizational sustainability.[38] One of the most recent collections of essays on ecological

35. Noss, *supra* note 34, at 356–57 (biodiversity includes processes and elements over broad scales).

36. James Karr, *Measuring Biological Integrity: Lessons from Streams, in* ECOLOGICAL INTEGRITY AND THE MANAGEMENT OF ECOSYSTEMS 83, 85 (Stephen Woodley et al. eds., 1993). This definition includes species composition, diversity, and functional organization as elements to compare with the natural habitat of a region. Paul L. Angermeier & James R. Karr, *Biological Integrity Versus Biological Diversity as Policy Directives*, 44 BIOSCIENCE 690, 692 (1994). The origins of this definition derive from an application by James R. Karr and Daniel R. Dudley, *Ecological Perspective on Water Quality Goals*, 5 ENVTL. MGMT. 55, 56 (1981), of a concept proposed in D. Frey, *Biological Integrity of Water: An Historical Perspective, in* U.S. EPA, THE INTEGRITY OF WATER 127 (R.K. Ballentine & L.J. Guarraia eds., 1975).

37. Angermeier & Karr, *supra* note 36, at 692.

38. Peter Miller, *Approaches to Ecological Integrity: Divergence, Convergence and Implementation, in* IMPLEMENTING ECOLOGICAL INTEGRITY: RESTORING REGIONAL AND GLOBAL ENVIRONMENTAL AND HUMAN HEALTH 57, 66–71 (P.A. Crabbé et al. eds., 2000). For reviews that categorize the various definitions of integrity, see also Peter Miller & James Ehnes, *Can Canadian Approaches to Sustainable Forest Management Maintain Ecological*

integrity extends the concept to include resilience and system ascendancy (a combination of measures aimed at an ecosystem's vigor and complexity of organization).[39]

When the term "biodiversity" first arose in the 1980s as a proposed synthesis of what is important to protect in nature, scientists and other commentators more often put it forward as an overarching goal for the law. Today, though, it generally makes more modest claims of capturing the whole of what is essentially natural than integrity does. As recognized by the 2001 FWS policy, contemporary diversity definitions converge on the elements of life and its processes.[40] How those elements are structured gets into the realm of integrity.[41] For many commentators, diversity is a part of integrity. For example, Paul L. Angermeier and James R. Karr, advocates of integrity as the best overarching goal for resource management, explain:

> Biological integrity refers to a system's wholeness, including presence of all appropriate elements and occurrence of all processes at appropriate rates. Whereas diversity is a collective property of system elements, integrity is a synthetic property of the system. Unlike diversity, which can be expressed simply as the number of kinds of items, integrity refers to conditions under little or no influence from human actions; a biota with high integrity reflects natural evolutionary and biogeographic processes.[42]

In the early 1990s, health enjoyed the spotlight as a new organizing normative principle for nature conservation.[43] Of the three

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Integrity?, *in* ECOLOGICAL INTEGRITY: INTEGRATING ENVIRONMENT, CONSERVATION, AND HEALTH, *supra* note 22, at 157, 159; Stephen Woodley, *Monitoring and Measuring Ecosystem Integrity in Canadian National Parks*, *in* ECOLOGICAL INTEGRITY AND THE MANAGEMENT OF ECOSYSTEMS 155, 156–58 (Stephen Woodley et al. eds., 1993).

39. Laura Westra et al., *Ecological Integrity and the Aims of the Global Integrity Project*, *in* ECOLOGICAL INTEGRITY: INTEGRATING ENVIRONMENT, CONSERVATION, AND HEALTH, *supra* note 22, at 26–29.

40. U.S. FISH & WILDLIFE SERV., U.S. FISH AND WILDLIFE SERVICE MANUAL, 601 FW 3.6(B), *available at* http://policy.fws.gov/manual.html (last visited Dec. 3, 2004); Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System, 66 Fed. Reg. 3810, 3818 (Jan. 16, 2001).

41. *See, e.g.*, Edward O. Wilson, *Biodiversity: Wildlife in Trouble*, *in* THE BIODIVERSITY CRISIS: LOSING WHAT COUNTS, *supra* note 34, at 18; RICHARD O. BROOKS ET AL., LAW AND ECOLOGY: THE RISE OF THE ECOSYSTEM REGIME 212–13 (2002); WILSON, *supra* note 34; Ehrlich & Levin, *supra* note 34.

42. Angermeier & Karr, *supra* note 36, at 692.

43. *See generally* ECOSYSTEM HEALTH: NEW GOALS FOR ENVIRONMENTAL MANAGEMENT, *supra* note 22; BRYAN G. NORTON, TOWARD UNITY AMONG ENVIRONMENTALISTS (1991).

terms, "health" has the shallowest roots in science. It is essentially a metaphor from medicine that indicates a preferred state for an ecosystem.[44] Indeed, the International Society for Ecosystem Health traces its roots to a 1991 conference called "Ecosystem Medicine: Developing a Diagnostic Capability."[45] A commonly used, early definition of ecosystem health is "[a]n ecological system is healthy...if it is stable and sustainable—that is, if it is active and maintains its organization and autonomy over time and is resilient to stress."[46] Health's variations include attributes related to homeostasis, the absence of disease, complexity, vigor, and balance.[47] Its definitions substantially overlap with those for integrity. Definitions specifically for ecosystem health, however, are more likely to incorporate human activities and consequences.[48]

One way to make sense of the three terms is to view them as ideas that encapsulate what society should care about in nature protection.[49] Once we understood, as a policy matter, that counting species was not a sufficient measure for an ecological conservation goal, we looked to new measures. In the 1980s, diversity was the term that captured that broader outlook.[50] However, its origins in (and association with) the species extinction crisis tended to limit its effectiveness as an organizing principle. For instance, the U.S. Forest Service has been able

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44. James R. Karr, *Health, Integrity, and Biological Assessment: The Importance of Measuring Whole Things*, *in* ECOLOGICAL INTEGRITY: INTEGRATING ENVIRONMENT, CONSERVATION AND HEALTH, *supra* note 22, at 209, 211–12; Peter Miller & Laura Westra, *Introduction*, *in* JUST ECOLOGICAL INTEGRITY: THE ETHICS OF MAINTAINING PLANETARY LIFE xix (Peter Miller & Laura Westra eds., 2002).

45. D.J. Rapport et al., *Ecosystem Health: The Concept, the ISEH, and the Important Tasks Ahead*, 5 ECOSYSTEM HEALTH 82, 82 (1999).

46. Benjamin D. Haskell et al., *Introduction: What Is Ecosystem Health and Why Should We Worry About It?*, *in* ECOSYSTEM HEALTH: NEW GOALS FOR ENVIRONMENTAL MANAGEMENT, *supra* note 22, at 9. This definition emerged from a 1990 Aspen Institute workshop.

47. Robert Costanza, *Toward an Operational Definition of Ecosystem Health*, *in* ECOSYSTEM HEALTH: NEW GOALS FOR ENVIRONMENTAL MANAGEMENT, *supra* note 22, at 239; M.T. Mageau et al., *The Development and Initial Testing of a Quantitative Assessment of Ecosystem Health*, 1 ECOSYSTEM HEALTH 201 (1995).

48. Rapport et al., *supra* note 45, at 84.

49. The Literacy Guidelines Working Group of the Society for Conservation Biology's Education Committee recently completed its outline of the central principles and concepts of conservation biology. Its framework parallels the Act's integrity-diversity-health criterion by organizing "three important aspects of life on Earth" into the categories "biological diversity," "ecological integrity," and "ecological health." Stephen C. Trombulak et al., *Principles of Conservation Biology: Recommended Guidelines for Conservation Literacy from the Education Committee of the Society for Conservation Biology*, 18 CONSERVATION BIOLOGY 1180, 1182 (2004).

50. *See generally* DAVID TAKACS, THE IDEA OF BIODIVERSITY: PHILOSOPHIES OF PARADISE (1996).

to justify forest plans on the basis that promoting more species in an area by increasing edge habitat fulfills its diversity mandate, despite the deviation from the area's historic mix of species and biota.[51] Also, some of diversity's purported manifestations, such as stability, proved to be less clear than originally thought.[52]

Almost 60 years ago, Aldo Leopold defined his land ethic in terms of the "integrity, stability, and beauty of the biotic community."[53] In the past decade, "integrity" has enjoyed a renaissance.[54] The literature on ecological and biological integrity is beginning to outweigh even the more popularly recognized writings on biodiversity.[55]

The language of the Improvement Act, hammered out between 1991 and 1997, reflects this period during which the three terms were vying for recognition as the new, all-inclusive goal for articulating science-based nature protection. The Act provided a long-needed revision of the legal authority controlling the management of the refuge system. The interpretation of integrity, diversity, and health as covering (with cautionary redundancy) the important overarching concepts emerging in the science literature is particularly apt for organic legislation. The interpretation also matches the looseness of the management-oriented literature, compared to the articles in the biological and ecological journals.[56] The technical literature treats the three terms as substantially equivalent from the perspective of their basic management requirements. Each term has a claim to represent the

51. Sierra Club v. Marita, 46 F.3d 606 (7th Cir. 1995); Oliver A. Houck, *On the Law of Biodiversity and Ecosystem Management*, 81 MINN. L. REV. 869, 909-15 (1997) (criticizing the Forest Service's and the court's interpretation of the NFMA diversity mandate); *see also* Angermeier & Karr, *supra* note 36, at 692 (citing the example of the Apalachicola River basin where reduced freshwater flow increases species diversity at the expense of productivity and overall integrity).

52. *See, e.g.*, Ichiro Aoki, *Diversity-Productivity-Stability Relationship in Freshwater Ecosystems: Whole-systemic View of All Trophic Levels*, 18 ECOLOGICAL RES. 397 (2003); Stuart L. Pimm, *Community Stability and Structure*, *in* CONSERVATION BIOLOGY: THE SCIENCE OF SCARCITY AND DIVERSITY 309, 311-22 (Michael E. Soule ed., 1986); ROBERT M. MAY, STABILITY AND COMPLEXITY IN MODEL ECOSYSTEMS (1973).

53. ALDO LEOPOLD, A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE 224-25 (Oxford Univ. Press 1989) (1949).

54. *See, e.g.*, IMPLEMENTING ECOLOGICAL INTEGRITY: RESTORING REGIONAL AND GLOBAL ENVIRONMENTAL AND HUMAN HEALTH (P. Crabbé et al. eds., 2000); JUST ECOLOGICAL INTEGRITY: THE ETHICS OF MAINTAINING PLANETARY LIFE, *supra* note 44; ECOLOGICAL INTEGRITY: INTEGRATING ENVIRONMENT, CONSERVATION, AND HEALTH, *supra* note 22; LAURA WESTRA, LIVING IN INTEGRITY: A GLOBAL ETHIC TO RESTORE A FRAGMENTED EARTH (1998).

55. *Cf.* THE BIODIVERSITY CRISIS: LOSING WHAT COUNTS, *supra* note 34; WILSON, *supra* note 34, at 393; BIODIVERSITY (Edward O. Wilson ed., 1988).

56. *See generally* LESLIE PAUL THIELE, ENVIRONMENTALISM FOR A NEW MILLENNIUM: THE CHALLENGE OF COEVOLUTION (1999).

biological (and social) insights that force us to widen our horizons on what counts in conservation. Each is referenced as a substantive component in the common variations of ecosystem management.[57] An interpretation of the terms as three ways of saying the same thing runs afoul of the canon of interpretation against surplusage, discussed in the following section. But, it nonetheless has a legitimate historical claim for the most accurate reading of the statute.

IV. INTERNAL CONTEXT

Even strict textual analysis considers the internal context of statutory language. This means evaluating not just the meaning of individual words but also the relationship among words. The way in which the substantive management criteria relate to each other provides this internal context, which clarifies their meaning.[58] Textual analysis may range from a narrow examination of just that section of the act containing the substantive management criterion to a broad, holistic view of the entire act. Most judges and agencies will strive to interpret a statute in such a way as to facilitate the objectives Congress expressed in the legislation.[59] That method of interpretation goes by several names, including purposism.[60]

Courts often employ hoary canons of interpretation that summarize logical inferences and presumptions of textual analysis. For example, in the *Sweet Home* case discussed in section III.A,[61] the lower court relied on the canon *noscitur a sociis*, or "a word is known by the company it keeps."[62] Under this canon, when "several items in a list share an attribute," courts should interpret all "the other items as

57. *E.g.*, ROBERT B. KEITER, KEEPING FAITH WITH NATURE: ECOSYSTEMS, DEMOCRACY, AND AMERICA'S PUBLIC LANDS 72 (2003) (an ecosystem management principle ensures that healthy natural resource systems and biodiversity be maintained); R. Edward Grumbine, *Reflections on "What Is Ecosystem Management?,"* 11 CONSERVATION BIOLOGY 41, 43 (1997) (an ecosystem management theme includes sustaining ecological integrity).

58. The term "internal context" is borrowed from my colleague, Bill Popkin. WILLIAM D. POPKIN, MATERIALS ON LEGISLATION: POLITICAL LANGUAGE AND THE POLITICAL PROCESS 198 (2d ed. 2001) (describing internal context as the text surrounding the words of which a reader is discerning meaning).

59. Even strict textualists, such as Judge Easterbrook, look to the function or purpose of a statutory provision in order to ascertain its meaning. *See, e.g., In re* Erickson, 815 F.2d 1090, 1094 (7th Cir. 1987).

60. WILLIAM D. POPKIN, STATUTES IN COURT: THE HISTORY AND THEORY OF STATUTORY INTERPRETATION 151-55 (1999).

61. *Sweet Home*, *supra* note 21.

62. Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or., 17 F.3d 1463, 1465-66 (D.C. Cir. 1994); *see also Sweet Home*, *supra* note 21, at 694 (1995); ESKRIDGE ET AL., *supra* note 19, at 253-54 (2000).

possessing that attribute as well."[63] The lower court relied on *noscitur a sociis* to interpret the "harm" element of the ESA "take" definition, which also includes the elements harass, pursue, hunt, shoot, wound, kill, trap, capture, and collect.[64] According to the lower court, *noscitur a sociis* indicates that "harm" does not include a range of incidental effects on protected species related to habitat degradation. Because the other terms in the take definition suggest "affirmative conduct intentionally directed against a particular animal or animals" or direct application of force, *noscitur a sociis* leads to the conclusion that harm does not include indirect adverse impacts from habitat modification.[65]

The Supreme Court overruled the lower court, concluding that the lower court misapplied *noscitur a sociis* by attributing to harm the same function as the other words in the take definition. The Supreme Court held that gathering meaning from surrounding words, as *noscitur a sociis* calls for, does not demand that the words all mean the same thing. Indeed, that would conflict with a counterbalancing canon, the rule against surplusage.[66] The rule against surplusage reflects the presumption that every statutory term makes some contribution to the operation of a law.[67] The term "harm" should not be interpreted in such a way as to add nothing that the other terms defining take already encompass. "Harm" shares with the other terms in the ESA definition of "take" a sense of injury to individual animals but extends injury to include habitat modification under certain circumstances. Nonetheless, the two canons of interpretation do not work perfectly to parse the sloppy language of Congress. For instance, it is difficult to understand how "wound" adds anything to the definition of "take" not covered by "harm." Because Congress is not a logic machine, it often drafts statutes with terms that are not parallel in their coverage. The Improvement Act, as well as the ESA, reflects this messy reality.

The Supreme Court has explained that statutory construction is a "holistic endeavor" that "must not be guided by a single sentence or member of a sentence, but look to the provisions of the whole law, and to its object and policy."[68] A holistic interpretation of the mandate to maintain biological integrity, diversity, and environmental health, like purposism, supports the importation of the science-based definitions

63. *Sweet Home*, *supra* note 21, at 720–21 (Scalia, J., dissenting).
64. 16 U.S.C. § 1532(19) (2000).
65. *Sweet Home*, *supra* note 21, at 720 (Scalia, J., dissenting).
66. *Id.* at 698.
67. ESKRIDGE ET AL., *supra* note 19, at 266–67.
68. U.S. Nat'l Bank of Or. v. Indep. Ins. Agents of Am., 508 U.S. 439, 455 (1993) (Souter, J., for a unanimous Court).

into the legal realm. A chief purpose of the 1997 Act was to provide the refuge system with its first overarching mission. That mission calls for sustaining and, "where appropriate," restoring and enhancing healthy populations of plants and animals.[69] Wildlife management and conservation biology are fields of science that study what these aims are and how they are best achieved. In addition, Congress explicitly included the "methods and procedures associated with modern scientific resource programs" in the mission definition as the means for achieving the refuge system purpose.[70]

Noscitur a sociis and its partner, the rule against surplusage, interpret each term to share some attribute with the others, yet contribute something different to the overall meaning of the mandate. Here, again, the technical literature comes to our aid in defining the content of the overlaps and differences. The 2001 FWS policy,[71] which navigates the strait between *noscitur a sociis* and the rule against surplusage, differentiates the terms but leaves a large area of intersection. This view, which accurately generalizes the weight of the technical literature, is illustrated in Figure 1. The common attribute of the three terms is related to the proper functioning of ecosystems. The FWS implementing policy reflects this understanding with its emphasis on the way ecosystems work (or, *i.e.*, process the energy and materials of life). More broadly, all terms share a concern for the large-scale, long-term ecological risks of human activities. This is the resource management law analog to the human health risks that preoccupy implementation of pollution control law.

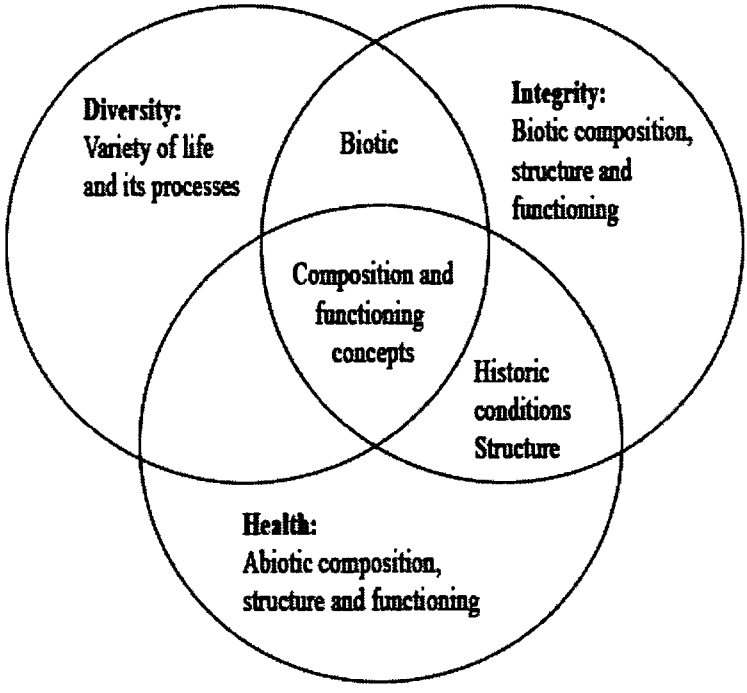
On the other hand, the 2001 policy departs somewhat from the science literature in interpreting the differences between the terms. The scholarly commentary does not divide the ecological world into three distinct categories: integrity-diversity-health. Just as harm subsumes injury in the ESA definition of take, most technical definitions of integrity subsume diversity. Also, "environmental" and "health" are terms that generally include biotic components. Nonetheless, these are relatively minor deviations from the literature that are justified by the need to construct a set of definitions that are both interlocking and distinct.

69. 16 U.S.C. § 668ee(4) (2000).

70. *Id.*

71. U.S. FISH & WILDLIFE SERV., *supra* note 40, 601 FW 3; Notice of Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System, 66 Fed. Reg. 3810 (Jan. 16, 2001).

Figure 1: The 2001 FWS Policy's Interpretation of the Meanings of "Biological Integrity," "Diversity," and "Environmental Health"



V. LEGISLATIVE HISTORY

The legislative history of the Improvement Act will be relevant for the vast majority of judges who employ a pragmatic approach to statutory interpretation. The history follows a trajectory that illustrates why Congress chose the 1997 language. As the Supreme Court explained in 1992:

> A statute, like other living organisms, derives significance and sustenance from its environment, from which it cannot be severed without being mutilated. Especially is this true where the statute, like the one before us, is part of a legislative process having a history and a purpose. The meaning of such a statute cannot be gained by confining inquiry within its four corners. Only the historic process of which such legislation is an incomplete fragment—that to

> which it gave rise as well as that which gave rise to it—can yield its true meaning.[72]

The drafting history of the Act reflects Congress's struggle to provide a modern organic authority for the refuges. This overarching purpose combined with the more immediate need to abate incompatible uses while at the same time endorsing hunting. Although the language changed from year to year and draft to draft as Congress considered more than a dozen bills, the purpose of the proposed legislation remained constant.

Between the enactment of the first comprehensive refuge system management statute in 1966 and the 1990s, Congress revised most of the important public land laws. In doing so, Congress developed the hallmarks of modern organic legislation.[73] Yet, prior to 1997, the refuge system law lacked a clearly defined mission, limited mandatory unit-level planning to Alaska, and contained few substantive management criteria other than a compatibility principle protecting the establishment purposes of each individual refuge. Throughout the 1990s, however, as refuge management issues surfaced in Congress, proposed legislation increasingly coalesced around the need for new organic authority.

As is often the case, specific problems with agency administration spurred most of the legislative action. Throughout the 1980s, refuge managers, the General Accounting Office, and environmental groups were sounding alarms about the threats to biological resources posed by certain uses of the refuges.[74] The failure of the FWS to control activities such as grazing, water management, and power boating on many refuges was allowing substantial environmental harm.[75] Although part of the problem stemmed from jurisdictional limitations, Congress increasingly viewed the existing refuge organic law as inadequate to the task of holding together a nature protection *network*.

Versions of the integrity-diversity-health mandate were a part of even the earliest models of proposed legislation to address incompatible uses and the outmoded character of the 1966 Refuge Administration Act. Senator Bob Graham introduced the first bill revising refuge organic

72. United States v. Thompson/Ctr. Arms Co., 504 U.S. 505, 516 n.8 (1992) (quoting Justice Frankfurter).

73. Fischman, *supra* note 12, at 501-13 (the five hallmarks of modern organic legislation are purpose statements, designated uses, comprehensive planning, substantive management criteria, and public participation).

74. *See Review of the Management of the National Wildlife Refuge System: Joint Hearing*, 101st Cong. (1989); U.S. GEN. ACCOUNTING OFFICE, GAO/RCED-89-196, NATIONAL WILDLIFE REFUGES: CONTINUING PROBLEMS WITH INCOMPATIBLE USES CALL FOR BOLD ACTION (1989).

75. For a review of these developments, see Fischman, *supra* note 12, at 493-99.

legislation in 1991. It mandated protection of the refuge system "from threats to the ecological integrity of such System and components."[76]

This terminology differs from the 1997 Act in two important ways. First, the 1991 bill seeks to protect something called "ecological integrity," which is defined neither in the bill nor in the committee's interpretive material. In explaining why the administration would not support the 1991 bill, John Turner, then-Director of the FWS, cautioned that the lack of a clear definition for such terms as "natural diversity" and "naturally healthy wildlife populations" would limit the law's usefulness and would spur litigation to clarify meanings.[77] Notably, the same criticism could be leveled at the integrity provision. Second, the 1991 bill would have required the Interior Department to protect the refuge system from threats to integrity rather than imposing an affirmative mandate to maintain integrity, as the 1997 law does.

Senator Graham's 1991 proposed refuge organic legislation also contained provisions highlighting the systemic goal of conserving biological diversity. The bill would have established a refuge system purpose to "ensure naturally diverse, healthy, and abundant populations of fish, wildlife, and plant species."[78] In addition, it mandated that the FWS "plan, propose, and direct the expansion" of the refuge system to conserve elements of "natural diversity."[79] However, these provisions did not directly give rise to the 1997 integrity-diversity-health mandate. Instead, they are progenitors of the statement of the system purpose[80] and the guidance for system expansion.[81] As such, they are of minor importance in tracing the direct origins of the 1997 management criterion. They do, however, illustrate the cross-cutting and steady concern that Congress expressed over declining biological diversity and the special role that refuges can play in restoring nature.[82] The 1991 bill shows that the integrity-diversity-health language was used, in some form, at the beginning of the legislative journey to the Improvement Act.

The "ecological integrity" language from the 1991 bill reappeared in two 1993 bills in a virtually unchanged and unclarified

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76. S. 1862, 102d Cong. § 4(a)(4)(B) (1991).

77. *National Wildlife Refuge System Management and Policy Act: Hearing Before the Subcomm. on Envtl. Protection of the Senate Comm. on Env't and Public Works*, 102d Cong. 12 (1992).

78. S. 1862, § 4(a)(2)(B).

79. *Id.* § 4(a)(2)(D).

80. *See* 16 U.S.C. § 668dd(a)(1) (2000).

81. *Id.* § 668dd(a)(4)(C)).

82. *See* S. REP. NO. 103-324, at 13 (1994) (describing the loss of biodiversity and the role the refuges can play in a network of lands to conserve biodiversity).

form.[83] An early signal that Congress did not distinguish between "ecological integrity" and "biological integrity" is Senate Bill 823, introduced in 1993 with the "ecological integrity" mandate.[84] Despite the bill's literal language, its committee report described the provision's mandate as protecting refuges from threats to their "biological integrity."[85]

Legislative history and dictionary definitions (but not the science literature) often employ biological integrity and ecological integrity interchangeably.[86] The word "ecological," however, carries a political association with environmentalism that "biological" lacks. One important reason for the abandonment of "ecological" in the proffered bills preceding the 1997 Act and in the transition from the draft to the final policy for biological integrity, diversity, and environmental health was a desire to avoid inflaming congressional opponents of environmental protection.[87]

By 1996, proposed organic legislation for the refuges began incorporating the terms of the Improvement Act.[88] A 1996 bill mandated that the Interior Secretary "ensure that the biological integrity and environmental health" of the refuges be maintained.[89] A competing 1997 bill to the one ultimately enacted contains an identical mandate.[90] The legislative history interpreting these mandates adds nothing to the record establishing their meaning.

The path from the 1991 Graham bill's mandate to safeguard the refuge system's "ecological integrity" to the 1997 enacted provision to maintain "biological integrity, diversity, and environmental health" is mostly a semantic rather than a substantive journey. It reflects a

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83. H.R. 833, 103d Cong. § 4 (1993); S. 823, 103d Cong. § 5(B) (1993) (as reported in S. REP. NO. 103-324).

84. S. 823, 103d Cong. § 5(B) (1993).

85. S. REP. NO. 103-324, at 15 (1994). Elsewhere, the committee report describes the bill's mission for refuges as contributing "significantly to the ecological integrity" of the ecosystems in which they occur. *Id.* at 12.

86. The scientific literature sometimes distinguishes "ecological," which includes both biotic and abiotic aspects, from "biological," which focuses on just living aspects. James R. Karr, *Beyond Definitions: Maintaining Biological Integrity, Diversity, and Environmental Health in National Wildlife Refuges*, 44 NAT. RESOURCES J. 1067 (2004).

87. This also explains the use of the unmodified term "diversity" rather than "biodiversity" or "biological diversity."

88. *See* Exec. Order No. 12,996, 61 Fed. Reg. 13,647 (Mar. 28, 1996) (mandating the "Directives of the Secretary of Interior," to include one to "ensure that the biological integrity and environmental health" of the refuges are maintained). The 1997 Improvement Act found the 1996 executive order to be "a positive step...[serving] as the foundation for the permanent statutory changes" enacted. Pub. L. No. 105-57, 111 Stat. 1252, § 2(8) (1997).

89. H.R. 1675, 104th Cong. § 5(a)(4)(K) (1996).

90. H.R. 511, 105th Cong. § 5(a)(4)(K) (1997).

congressional search for a set of terms that would be both politically acceptable and scientifically recognizable as objectives related to conservation biology. As section III.B discusses, each term (integrity, diversity, and health) has its advocates for the case that it captures the whole of what is important to measure and protect in nature. With the technical literature in flux, Congress hedged its bets and employed all three terms that were jostling for supremacy in the 1990s. Congress attempted to cover all bases to make sure that it imposed on the FWS a mandate that would harmonize with the science of nature repair, conservation biology.[91] I believe that the drafters of the 1997 statute recognized a substantial overlap, if not redundancy, among the terms.

VI. BROAD LEGAL CONTEXT

A review of how laws employing integrity, diversity, and health terminology have evolved over the past 30 years also informs our understanding of the Improvement Act. The Supreme Court's notion of a "holistic" approach to statutory interpretation includes consideration of a statute's historical context and subject matter.[92] The historical context adds a dynamic element to the analysis. Most statutory interpretation is dynamic in the sense that the meanings and values embodied in legislation change over time.[93]

The subject matter of the other laws employing similar terms situates the Improvement Act within the larger statutory landscape of environmental law.[94] This part of the analysis cuts across statutes to find patterns of usage and meaning. The Improvement Act is the only statute in which Congress used the terms integrity, diversity, and health together. However, Congress has employed the terms separately for decades to express nature protection goals. Any understanding of the meaning of the mandate for the refuges ought to be informed by the way

91. Congress largely succeeded in articulating the current thinking of conservation biology. In its new outline of the central principles and concepts of conservation biology, the Literacy Guidelines Working Group of the Society for Conservation Biology's Education Committee organized "the three important aspects of life on Earth" into the categories "biological diversity," "ecological integrity," and "ecological health." Stephen C. Trombulak et al., *Principles of Conservation Biology: Recommended Guidelines for Conservation Literacy from the Education Committee of the Society for Conservation Biology*, 18 CONSERVATION BIOLOGY 1180, 1181 (2004).

92. *See* U.S. Nat'l Bank of Or. v. Indep. Ins. Agents of Am., 508 U.S. 439, 455 (1993); United States v. Thompson/Ctr. Arms Co., 504 U.S. 505, 516 (1992).

93. *See generally* WILLIAM N. ESKRIDGE, JR., DYNAMIC STATUTORY INTERPRETATION (1994).

94. Context within the larger statutory landscape aids interpretation of legislation. *See generally* GUIDO CALABRESI, A COMMON LAW FOR THE AGE OF STATUTES (1982).

in which the terms are used in other environmental laws. Even Justice Scalia, the strict constructionist, accepts that it is the role of the courts to "make sense rather than nonsense out of *corpus juris*."[95] Justice Scalia writes, "it is well established that a court can, and should, interpret the text of one statute in light of text of surrounding statutes, even those subsequently enacted."[96]

A. Integrity

Integrity has long been a concern of conservationists. The father of modern environmentalism, Aldo Leopold, defined his land ethic to deem a thing right "when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."[97] "Biological integrity" entered the environmental law lexicon with the landmark 1972 amendments to the Federal Water Pollution Control Act (commonly called the Clean Water Act or CWA). The very first section of the law established the objective to "restore and maintain the chemical, physical, and biological integrity" of the waters of the United States.[98] This early aspirational statement of modern environmental policy has influenced many agreements, laws, and orders.[99]

Though an important guiding principle for interpreting the CWA,[100] the integrity goal is not animated by a strong operational command in the requirements Congress set out for agency implementation.[101] In this respect, the use of the term "integrity" in the CWA is analogous to the refuge organic bills in the 1990s that mentioned the importance of conserving biological diversity in the system mission. Without a partner provision commanding an agency specifically to

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95. W. Va. Univ. Hosp. v. Casey, 499 U.S. 83, 101 (1991).

96. Vt. Agency of Natural Res. v. United States *ex rel.* Stevens, 529 U.S. 765, 786 n.17 (2000).

97. LEOPOLD, *supra* note 53.

98. Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500 § 101(a), 86 Stat. 816, 816 (codified at 33 U.S.C. § 1251(a) (2000)).

99. For example, the 1978 U.S.-Canadian Great Lakes Water Quality Agreement adopts for its goal the integrity language from the 1972 Clean Water Act. ROBERT W. ADLER ET AL., THE CLEAN WATER ACT: 20 YEARS LATER 221 (1993).

100. *See, e.g.*, P.F.Z. Props., Inc. v. Train, 393 F. Supp. 1370, 1381 (D.D.C. 1975) (interpreting the CWA broadly to regulate development in a mangrove swamp in part because the development would impair the biological integrity of the neighboring lagoon and ocean); United States v. Holland, 373 F. Supp. 665, 668 (M.D. Fla. 1974) (interpreting the CWA broadly for comprehensive regulation of wetlands to recapture and preserve "the biological integrity of the nation's water by creating a web of complex interrelated regulatory programs").

101. *See generally* Robert W. Adler, *The Two Lost Books in the Water Quality Trilogy: The Elusive Objectives of Physical and Biological Integrity*, 33 ENVTL. L. 29 (2003).

implement integrity, little turned on the EPA's definition of the term.[102] Indeed, defining integrity is not even necessary for the CWA program. In contrast, the Improvement Act's substantive management criterion bound the FWS to maintain biological integrity, diversity, and environmental health. It did not, however, require a more detailed account of how the agency will determine compliance.

The legislative history of the CWA defines integrity in a manner that is prescient of the ecological science that the clean water program would help instigate. The 1972 House committee report defined "integrity" as "a concept that refers to a condition in which the natural structure and function of ecosystems is maintained."[103] Furthermore, the 1972 CWA was not completely devoid of provisions that explicitly linked the agency program to the integrity goal. For example, the law requires the EPA to publish criteria to determine how well water quality meets the statutory goals.[104] These criteria include information on how to restore and maintain biological integrity[105] and protect and propagate a balanced indigenous population of "shellfish, fish and wildlife."[106] Such biological criteria are "narrative or numeric expressions that describe the reference biological integrity (structure and function) of aquatic communities inhabiting waters of a given designated aquatic life use."[107] Nonetheless, agency effort and judicial oversight in this part of the CWA program have focused almost exclusively on industry-specific (chemical) effluent limitations rather than the ambient water quality criteria.[108] Other parts of the CWA that mention biological integrity merely authorize grants or establish planning objectives.[109]

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102. *Id.* at 66–70.

103. *Id.* at 45; H.R. REP. NO. 92-911, at 76–77 (1972).

104. The EPA has implemented this mandate, in part, by promulgating national program guidance for biological criteria. These criteria seek to measure directly the structure and function of resident aquatic communities to determine whether they meet the statutory standard. *See* Robert L. Fischman, *Biological Diversity and Environmental Protection: Authorities to Reduce Risk*, 22 ENVTL. L. 435, 448 (1992).

105. Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500 § 304(a)(2), 86 Stat. 816, 850–51 (codified at 33 U.S.C. § 1314(a) (2000)).

106. *Id.* § 304(a)(2).

107. Adler, *supra* note 101, at 70; U.S. ENVTL. PROT. AGENCY, BASICS: WHAT ARE BIOCRITERIA AND BIOASSESSMENT DATA?, *at* http://www.epa.gov/ost/biocriteria/basics/ (last visited Nov. 13, 2004); OFF. OF WATER, U.S. ENVTL. PROT. AGENCY, BIOLOGICAL ASSESSMENTS AND CRITERIA: CRUCIAL COMPONENTS OF WATER QUALITY PROGRAMS (2002).

108. Adler, *supra* note 101, at 70–74; Karr, *supra* note 86.

109. 33 U.S.C. § 1254(r) (2000) (research grants to colleges and universities); *id.* § 1255(d)(3) (research and development grants); *id.* § 1270(e)(2)(A) (goals for a Lake Champlain plan); *id.* § 1330(b)(4) (goals for plans under the national estuary program); *id.* § 2317(b)(2)(A) (goals for a wetlands creation project in Arkansas). The integrity aspects of these and other EPA authorities received a burst of attention in the 1990s, after the Science

To find a management mandate for integrity more analogous to the criterion in the Improvement Act, one must turn to public land law. Public land law borrowed a general meaning of the term "integrity," not limited to its biological or ecological application, from the field of historic preservation. For example, in 1974, the federal government promulgated criteria for determining eligibility for protection under the National Historic Preservation Act. The criteria included (and still include) objects "that possess *integrity* of location, design, setting, materials, workmanship, feeling, and association."[110]

Congress picked up this standard in the 1978 Redwood amendments to the national park system organic act. One provision instructs the National Park Service to construe authorizations and conduct management "in light of the high public value and integrity of the National Park System."[111] Congress again employed this general integrity concept in a 1998 statute dealing with additions to the national park system.[112] The National Parks Omnibus Management Act of 1998 calls for studies and annual reports about areas that might contribute to the park system. The statute requires the studies to consider a number of factors, including "the rarity and integrity of the resources" in the potential park area.[113]

The first statute explicitly calling for conservation of biological or ecological integrity for a public land unit was the Everglades National Park Protection and Expansion Act of 1989.[114] This legislation continued the leadership tradition of the Everglades, which (in 1934) was the first national park that Congress established for preservation of flora and fauna.[115] In 1989, Congress revised not only the purpose of the park, but also the administration of the park. The 1989 Act requires the Interior

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Advisory Board released a report recommending that the EPA "attach as much importance to reducing ecological risk as it does to reducing human health risk." Fischman, *supra* note 104, at 439; SCI. ADVISORY BD., U.S. ENVTL. PROT. AGENCY, REDUCING RISK: SETTING PRIORITIES AND STRATEGIES FOR ENVIRONMENTAL PROTECTION 6 (1990); *see, e.g.*, Notice Requesting Applications Regarding a Project on Indicators of Ecosystem Stress, 58 Fed. Reg. 6788 (Feb. 2, 1993); U.S. EPA Science Advisory Board Notification of Public Advisory Committee Meetings, 61 Fed. Reg. 15,481 (Apr. 8, 1996); *see also* Fischman, *supra* note 104, at 439–40 (discussing the emergence of this trend).

110. Procedures for the Protection of Historic and Cultural Properties, 39 Fed. Reg. 3366, 3369 (Jan. 25, 1974) (emphasis added). The current version was repromulgated with the same phrasing at National Register of Historic Places, 46 Fed. Reg. 56,187, 56,189 (Nov. 16, 1981).

111. Act of Mar. 27, 1978, Pub. L. No. 95-250, § 101(b), 92 Stat. 163, 166 (1978).

112. National Parks Omnibus Management Act of 1998, Pub. L. No. 105-391, §§ 301–303, 112 Stat. 3497, 3501 (1998).

113. *Id.* § 303(c)(3)(A)(i).

114. Pub. L. No. 101-229, 103 Stat. 1946 (1989) (codified at 16 U.S.C. § 410r-5 (2000)).

115. Act of May 29, 1934, ch. 371, 48 Stat. 816.

Department to "maintain the natural abundance, diversity, and ecological integrity of native plants and animals, as well as the behavior of native animals, as part of their ecosystem."[116] Though some commentators regard "ecological integrity" as a separate, broader term than "biological integrity," the 1989 statute suggests that Congress uses the terms synonymously. If ecological integrity includes diversity but biological integrity does not, then the Everglades expansion language makes less sense.

Refuge establishment authority employing the integrity objective dates back even earlier than the Everglades expansion legislation, but derives from a quitclaim deed donating the refuge, not a statute. The 1973 establishment purpose for New Mexico's Sevilleta National Wildlife Refuge calls for preservation and enhancement of "the integrity and natural character of the ecosystems."[117] The purpose arose out of a negotiated transfer of a ranch from The Nature Conservancy, which had received the land as a donation.[118]

Subsequent to the 1997 Act, Congress imposed an ecological integrity purpose and planning mandate on the Bureau of Land Management's Steens Mountain Cooperative Management and Protection Area in Oregon.[119] This 2000 legislation picked up where the 1997 Improvement Act left off. In a set of provisions that reflects the greatest statutory refinement to date of the meaning of integrity, the Steens Mountain establishment law defines ecological integrity to mean:

> a landscape where ecological processes are functioning to maintain the structure, composition, activity, and resilience of the landscape over time, including—(A) a complex of plant communities, habitats and conditions representative of variable and sustainable successional conditions; and (B) the maintenance of biological diversity, soil fertility, and genetic interchange.[120]

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116. Pub. L. No. 101-229, §§ 101(b), 103(b), 103 Stat. 1946 (1989).

117. Fischman, *supra* note 12, at 603.

118. On the history of the Sevilleta National Wildlife Refuge, see U.S. FISH & WILDLIFE SERV., SEVILLETA NATIONAL WILDLIFE REFUGE, *at* http://southwest.fws.gov/refuges/newmex/sevilleta/history.html (last visited Nov. 13, 2004).

119. Steens Mountain Cooperative Management and Protection Act of 2000, Pub. L. No. 106-399, § 1, 114 Stat. 1655, 1655 (2000). The Act also establishes the area for the purpose of, among other things, ecological health. However, because the health component is neither defined nor contained in management prescriptions in the statute, I treat this law principally as a new development concerning integrity.

120. *Id.* § 2(5).

Note that the definition of integrity explicitly includes diversity as one of its elements. This runs counter to the way in which Congress used integrity and diversity in the Everglades National Park Protection and Expansion Act of 1989.[121] It suggests an expansion in the scope of the meaning of integrity.

The scientific substance of "integrity," as employed in the Steens Mountain legislation, places that statute at the forefront of the law advancing the integrity goal. But, there is more. Congress also required the Bureau of Land Management (BLM) to develop a plan for the Area that shall "determine measurable and achievable management objectives...to ensure the ecological integrity of the area."[122] The statute also requires the BLM to implement a monitoring program to evaluate "progress towards ecological integrity objectives."[123] Determining measurable objectives, and monitoring attainment of them, has the potential to do more to clarify what integrity is than any definition.[124] The BLM's plan is due this year and promises to be an early comparative case study indicating whether the Interior Department is moving in the right direction with the integrity-diversity-health criterion.[125] The requirements to determine measurable and achievable objectives and to monitor progress indicate that Congress continues to advance the evolution of our understanding of integrity through the law.

B. Diversity

Biological diversity is a term that has received considerably more attention in the law than has integrity.[126] Particularly as it relates to species diversity, biological diversity has also been closely associated

121. *Id.* § 103, 103 Stat. at 1948–49.

122. Steens Mountain Cooperative Management and Protection Act of 2000, § 111(b)(3).

123. *Id.* § 111(c).

124. The FWS has not yet made much progress in this area. However, it has established a performance goal to develop standardized methods to measure biological diversity and environmental health on all refuges. U.S. DEP'T OF THE INTERIOR, FISH AND WILDLIFE SERVICE ANNUAL PERFORMANCE PLAN FY 2001/ANNUAL PERFORMANCE REPORT FY 1999 42–45 (2000), *available at* http://planning.fws.gov/USFWFinal.pdf (last visited Nov. 13, 2004).

125. Public comment on the draft management plan closed on January 5, 2004. *See* Andrews Mgmt. Unit/Steens Mountain Coop. Mgmt. & Prot. Area, Draft Resource Management Plan/Environmental Impact Statement, *at* http://www.or.blm.gov/Burns/Planning/AndrewsSteensRMP/Draft_RMP/Draft.html (last visited Nov. 13, 2004).

126. Biological diversity has also received more popular attention. Of the three terms in the 1997 mandate, only biological diversity has an entry in the general reference source, THE COLUMBIA ENCYCLOPEDIA 309 (6th ed. 2000) ("number of species in a given habitat"). Note that this generalist definition is narrower (limited to species diversity) than most of the agency and scientific definitions.

with refuges. Theodore Roosevelt established Pelican Island, the first refuge, to prevent extinctions. The first federal endangered species protection statute included the authority now known as the 1966 Refuge Administration Act. Until the 1973 Endangered Species Act (ESA), the national wildlife refuge system was the single most important federal program designed to recover species on the brink of dying out.

However, extinction concerns were seldom framed in the larger context of biological diversity—or biodiversity—until the National Academy of Sciences teamed up with the Smithsonian Institution in 1986 to convene the "National Forum on BioDiversity."[127] Indeed, the ESA itself does not even contain the word "diversity," despite the fact that maintaining species diversity is its principal aim. The 1986 forum, and the popular book it produced,[128] changed the terminology and perception of nature protection. After 1986, biological diversity was increasingly understood to encompass genetic and ecosystemic variety. Perhaps more importantly, it also expanded in scope to include the processes of life, the structural elements of natural communities, and the functioning of ecosystems.[129]

Nonetheless, Congress did employ diversity in its modern biological sense before the 1980s. One of the earliest and most outrageous uses of the diversity term in its ecological sense occurs in the Wild, Free-Roaming Horses and Burros Act of 1971. That law declares that the feral equids "contribute to the diversity of life forms" and should be protected "as an integral part of the natural system of the public lands."[130] Protecting what one commentator calls "noxious herbivores" is notoriously at odds with the modern scientific preference for conservation of native species.[131] As Professor Bruce E. Coblentz, an expert on ungulate species at Oregon State University, notes, "[l]egal status does not equate with ecological legitimacy."[132]

The following year, Congress enacted the modern CWA, which played an influential role in promoting the concept of biological

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127. TAKACS, *supra* note 50, at 34–40.

128. BIODIVERSITY, supra note 55.

129. *See, e.g.*, TAKACS, *supra* note 50, at 46–52 (1996); Hal Salwasser, *In Search of an Ecosystem Approach to Endangered Species Conservation*, *in* BALANCING ON THE BRINK OF EXTINCTION: THE ENDANGERED SPECIES ACT AND LESSONS FOR THE FUTURE 247, 251–54 (Kathryn A. Kohm ed., 1991); COUNCIL ON ENVTL. QUALITY, ENVIRONMENTAL QUALITY: TWENTY-FIRST ANNUAL REPORT 135–87 (1990); OFFICE OF TECH. ASSESSMENT, U.S. CONGRESS, TECHNOLOGIES TO MAINTAIN BIOLOGICAL DIVERSITY (1987).

130. Wild, Free Roaming Horses and Burros Act, Pub. L. No. 92-195, § 1, 85 Stat. 649, 649 (1971) (codified at 16 U.S.C. § 1331 (2000)).

131. Bruce E. Coblentz, *Letter to the Editor*, 13 NAT. AREAS J. 3 (1993).

132. *Id.*

integrity.[133] The CWA also contained an important diversity provision. That provision required the EPA to develop water quality criteria reflecting the latest scientific knowledge of "the effects of pollutants on biological community diversity, productivity, and stability."[134] States either employ these criteria to measure water quality or to justify the development of their own criteria. Congress applied the foregoing water quality criteria language again in commanding that the EPA issue guidelines to determine the extent of marine water degradation. The guidelines must consider the effect of ocean disposal on "marine ecosystem diversity, productivity, and stability; and species and community population changes."[135]

The National Forest Management Act (NFMA) contains the most important statutory application of the diversity concept from the 1970s.[136] Enacted in response to the judicial invalidation of national forest clear-cutting practices, the NFMA nonetheless comprehensively revised the legal charter of the national forest system. In a decade of tremendous legislative attention to the reform of public land laws, the 1976 NFMA was the high-water mark for statutory detail to control resource management. To bind the Forest Service to high conservation standards, the NFMA requires the agency to promulgate regulations governing unit-level planning. The plans resulting from implementation of the regulations create a site-specific law of the forest.

The NFMA calls for the unit-level plans to:

> provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives...[and] provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan.[137]

Despite the fact that the NFMA modifies its diversity mandate with classic language of proprietary discretion ("in order to meet multiple-use objectives," "where appropriate," "to the degree practicable," and "similar"), this provision proved to be the most important substantive management criterion in public land law of the past quarter century.

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133. *See supra* notes 98-109 and accompanying text.

134. Federal Water Pollution Control Act, Pub. L. No. 92-500, § 304(a)(1)(c), 86 Stat. 816, 850 (codified at 33 U.S.C. § 1314(a)(1)(c) (2000)).

135. *Id.* § 403(c)(1)(B) (codified at 33 U.S.C. § 1343(c)(1)(B) (2000)).

136. Pub. L. No. 94-588, 90 Stat. 2949 (1976).

137. 16 U.S.C. § 1604(g)(3)(B) (2000).

The importance of the diversity mandate stems from the 1982 regulations the Forest Service adopted,[138] in consultation with an outside committee of scientists required by the NFMA.[139] The 1982 interpretation of the diversity criterion required forest plans to "[p]rovide for adequate fish and wildlife habitat to maintain viable populations of existing native vertebrate species."[140] It was the strength of this regulation, as compared to the text of the statute, that effectively halted the timber program in the Pacific Northwest during the late 1980s and early 1990s.[141] It also prompted ecosystem management in the national forests.[142] This aspect of species diversity is an important strength of the FWS policy implementing the integrity-diversity-health criterion, which "assur[es] that densities of endangered or otherwise rare species are sufficient for maintaining viable populations."[143]

By the 1990s, conservation of biological diversity had become so closely associated with national forests that Congress explicitly dealt with the issue in designating national recreation areas in the national forest system.[144] The Smith River National Recreation Area, designated in 1990, is a particularly strong example of Congress's deep engagement in meeting the diversity mandate for national forests. This establishment statute goes beyond mere mention of diversity as a purpose for the protective overlay of national recreation area status. It directs how the Forest Service should implement its organic authorities to further the establishment purposes (including the diversity goal). Employing more scientific terminology than is typical in this type of legislation, Congress constrains Forest Service administration by (1) allowing timber harvest only in areas managed to reduce habitat fragmentation and maintain

138. National Forest Management Act, 47 Fed. Reg. 43,026, 43,050 (Sept. 30, 1982).

139. 16 U.S.C. § 1604(h) (2000). Unlike the NFMA, the Improvement Act requires neither notice and comment rulemaking nor an independent committee of scientists to interpret the diversity (integrity and health) mandate. A mandate to convene an outside panel of scientists to recommend implementing guidelines for the integrity-diversity-health criterion would have further strengthened the textual case for the use of science.

140. National Forest Management Act, 47 Fed. Reg. 43,026, 43,050 (Sept. 30, 1982).

141. *See, e.g.*, Seattle Audubon Soc'y v. Moseley, 798 F. Supp. 1473 (W.D. Wash. 1992), *aff'd* Seattle Audubon Soc'y v. Espy, 998 F.2d 699 (9th Cir. 1993) (invalidating Forest Service plans because they failed to maintain viable populations of the northern spotted owl).

142. KEITER, *supra* note 57, at 79-126.

143. 66 Fed. Reg. 3810, 3821 (Jan. 16, 2001); U.S. FISH & WILDLIFE SERV., *supra* note 40, 601 FW 3.14(C).

144. Smith River National Recreation Act, Pub. L. No. 101-612, § 4, 104 Stat. 3209, 3210 (1990) (codified at 16 U.S.C. § 460bbb-2 (2000)) (establishing the Smith River National Recreation Area for the purpose of, among other things, preserving the ecological diversity of the area); Spring Mountains National Recreation Area Act, Pub. L. No. 103-63, 107 Stat. 297, 297 (1993) (establishing the Spring Mountain National Recreation Area for the purpose of, among other things, preserving biological diversity).

"biological diversity" by "providing for a high level of structural and compositional diversity in managed stands"; (2) requiring a written determination by the Secretary of Agriculture that timber removals are necessary to maintain "biological and ecological diversity"; and (3) mandating an emphasis in management on the maintenance of "ecologic and biologic diversity."[145] The 1990 congressional concern over habitat fragmentation is an early and rare manifestation of scientific sophistication. It is also a precursor to the 2000 FWS compatibility policy, which prohibits habitat fragmentation.[146] Moreover, it illustrates (in contrast with the Steens Mountain Cooperative Management and Protection Area legislation of 2000) how the diversity criterion predates, by about a decade, integrity as a subject of detailed statutory guidance.

Congress also introduced diversity protection purposes in national park establishment legislation. In 1988, Congress created a national park in American Samoa to preserve tropical forests that harbor biological diversity.[147] The 1989 revision of the Everglades National Park establishment law created a mission rooted in both integrity and diversity.[148]

Congress began focusing the FWS's attention on protecting natural diversity in refuges in 1980. The 1980 Alaska National Interests Lands Conservation Act (ANILCA) created new refuges and added land to existing refuges in Alaska. In delineating purposes for these refuges, Congress foreshadowed the concerns that would become more prominent in the Improvement Act. The ANILCA gave all nine new refuges and seven existing refuges the primary purpose of conserving "fish and wildlife populations and habitats in their natural diversity."[149] Between 1980 and the 1997 Improvement Act, Congress enacted nine statutes establishing individual refuge purposes that included natural diversity.[150] During this time, Congress also enacted a hodgepodge of

145. Smith River National Recreation Area Act § 5 (codified at 16 U.S.C. § 460bbb-3 (2000)).

146. 65 Fed. Reg. 62,484, 62,486 (Oct. 18, 2000); U.S. FISH & WILDLIFE SERV., *supra* note 40, 603 FW 2.5(A).

147. Act of Oct. 31, 1988, Pub. L. No. 100-571, § 1, 102 Stat. 2879, 2879 (codified at 16 U.S.C. 410qq (2000)) (establishing the National Park of American Samoa).

148. *See supra* notes 114-116 and accompanying text.

149. Alaska National Interest Lands Conservation Act, Pub. L. No. 96-487, §§ 302, 303, 94 Stat. 2371, 2385-2393 (1980).

150. Bon Secour National Wildlife Refuge Act, Pub. L. No. 96-267, § 4, 94 Stat. 483, 484 (1980) ("to conserve an undisturbed beach-dune ecosystem which includes a diversity of fish and wildlife"); Bandon Marsh National Wildlife Refuge Act, Pub. L. No. 97-137, tit. II, 95 Stat. 1709, 1710 (1981) ("to protect wildlife populations and habitats in their natural diversity"); Protection Island National Wildlife Refuge Act, Pub. L. No. 97-333, § 3(a), 96 Stat. 1623, 1623 (1982) ("to provide habitat for a broad diversity of bird species"); Wetlands

grant and aid programs to promote research in and protection of biological diversity.[151]

In 2000, following the success of his 1996 refuge system guidance[152] and his national monument designations, President Clinton signed a new executive order establishing a system of marine protected areas (MPAs).[153] The MPAs comprise a network of units managed by a wide range of agencies. The Clinton order sought to "develop a scientifically based, comprehensive national system of MPAs representing diverse U.S. marine ecosystems."[154] It remains to be seen whether this executive order, like the 1996 refuge system directive, will prompt and provide the language for organic legislation.

C. Health

Alhough there are more statutes that address health than integrity or diversity, few relate to nature protection. Instead, public health dominates, with its similar focus on collective (rather than

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Loan Act, Extension, Pub. L. No. 98-548, § 201(b), 98 Stat. 2774, 2774 (1984) ("to encourage natural diversity of fish and wildlife species"); Emergency Wetlands Resources Act of 1986, Pub. L. No. 99-645, § 502, 100 Stat. 3582, 3590 ("to encourage natural diversity of fish and wildlife species"); Wallkill River National Wildlife Refuge Act, Pub. L. No. 101-593, § 107, 104 Stat. 2954, 2955 (1989) (conserving "the natural diversity of fish, wildlife, plants, and their habitats"); Department of the Interior and Related Agencies Appropriations Act of 1992, Pub. L. No. 102-154, § 319(d), 105 Stat. 990, 1036 ("to encourage the natural diversity of plant, fish, and wildlife species"); Rocky Mountain Arsenal National Wildlife Refuge Act of 1992, Pub. L. No. 102-402, § 4(c), 106 Stat. 1961, 1965 ("to conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants, and their habitats"); Silvio O. Conte National Fish and Wildlife Refuge Act, Pub. L. No. 102-212, § 104, 105 Stat. 1655, 1656 (1991) ("to conserve, protect, and enhance the natural diversity and abundance of plant, fish, and wildlife species"). During the same period, other refuges established by non-legislative sources also contained diversity purposes. *See, e.g.*, Exec. Order No. 13,022, 61 Fed. Reg. 56,875, 56,875 (Oct. 31, 1996) (maintaining and restoring "natural biological diversity").

151. *See, e.g.*, 7 U.S.C. § 450i (2000) (agricultural research grants to determine global climate change on biological diversity); 22 U.S.C. § 262m-5 (2000) (instructing U.S. directors of multi-lateral development banks to promote the establishment of environmental programs to protect biological diversity); Special Foreign Assistance Act of 1986, Pub. L. No. 99-529, § 302, 100 Stat. 3010, 3017 (codified at 22 U.S.C. § 2151q (2000)) (Agency for International Development assistance to countries for the purpose of conserving biological diversity); Pub. L. No. 101-606, § 101, 104 Stat. 3096, 3096 (codified at 15 U.S.C. § 2931 (2000)) (global climate change research program to help understand human-induced climate changes that could adversely affect biological diversity).

152. *See supra* notes 6–7 and accompanying text.

153. Exec. Order No. 13,158, 65 Fed. Reg. 34,909 (May 26, 2000).

154. *Id.* at 34,909.

individual) well-being.[155] As it relates specifically to ecological concerns, health is the least common statutory element. But, it is growing in importance, especially with respect to its controversial application to forests.

In 1972, the Marine Mammal Protection Act (MMPA) established an elaborate regime to control the taking of marine mammals.[156] The MMPA is based, in part, on a congressional finding that the primary objective of marine mammal management should be "to maintain the health and stability of the marine ecosystem."[157] The central organizing concept animating the control framework is the replacement of the traditional, utilitarian "maximum sustained yield" target with a biological goal, the maintenance of an "optimum sustainable population" (OSP).[158] The statute defines OSP as "the number of animals which will result in the maximum productivity...keeping in mind the carrying capacity of the habitat and the *health* of the ecosystem of which they form a constituent element."[159] Scientists have criticized the OSP concept as returning to the same biologically questionable population dynamic assumptions as traditional fisheries management.[160] However, the OSP health language indicates that Congress grasped for a more holistic, scientifically defensible goal in the MMPA.

After the enactment of the MMPA, Congress focused its attention in applying the health concept to forest ecosystems. In particular, atmospheric deposition of acids led to calls for more research on the relationship between air pollution and forest decline. For example, the Forest Ecosystems and Atmospheric Pollution Research Act of 1988 established a program that investigated the causes and extent of changes in the "health" of "domestic forest ecosystems."[161] In 1990, Congress incorporated its concern about the adverse effects of acid deposition on ecosystems (especially forest and aquatic areas) into the Clean Air Act.[162] Pollution control law, however, more often employs the

155. Rapport et al., *supra* note 45, at 82–83 (ecosystem health extends the concept of "health" from its traditional domains of application at the individual and population levels to that of the whole ecosystem).

156. Pub. L. No. 92-522, 86 Stat. 1027 (1972).

157. *Id.* § 2(6), 86 Stat. at 1028.

158. DALE D. GOBLE & ERIC T. FREYFOGLE, FEDERAL WILDLIFE STATUTES: TEXTS AND CONTEXTS 29 (2002).

159. Pub. L. No. 92-522, § 3, 86 Stat. at 1028 (emphasis added).

160. *See* DANIEL B. BOTKIN, DISCORDANT HARMONIES 23 (1990).

161. Forest Ecosystems and Atmospheric Pollution Research Act of 1988, Pub. L. No. 100-521, 102 Stat. 2601.

162. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 404, 104 Stat. 2399, 2632 (codified at 42 U.S.C. § 7651 (2000)).

term "environmental health" to refer to public health concerns that cause human illness and injury.[163]

The term "forest health," as opposed to "ecosystem health," usually refers more specifically to concerns that trigger permission for salvage or sanitation logging.[164] Like the idea that feral horses and burros are an integral part of western ecosystems, the concept that prophylactic logging is necessary on a large scale to ensure forest health is controversial. Nonetheless, it is commonly embedded in the law. For instance, the Chattahoochee National Forest Protection Act of 1991 authorizes salvage logging in a designated scenic area, where needed to maintain forest health.[165]

More recently, concern over declining forest health has shifted from the eastern hardwoods to the western coniferous forests. Insect infestation and fire vulnerability in the west began to spur concern in the late 1980s. Unfortunately, in 1995 Congress tied the forest health treatment issue to expediting so-called salvage timber sales, which included controversial logging in areas earlier shut down due to adverse environmental impacts.[166] After that, "forest health" increasingly became a euphemism for initiatives aimed at weakening environmental protection and public participation, in order to promote more logging. This is also the sense in which the term is used in the 2003 Healthy Forests Restoration Act (HFRA).[167]

The HFRA's purposes are, among other things, "to protect watersheds and address threats to forest and rangeland *health*," and "to protect, restore, and enhance forest ecosystem components,...[including the improvement of] biological diversity."[168] However, the program authorized by the HFRA tells a story at odds with the health and diversity purpose. The principal operational program of the HFRA is "hazardous fuel reduction" projects for Forest Service and BLM lands.[169] The statute authorizes these projects with limitations on NEPA compliance, administrative appeals, and judicial jurisdiction for

163. *See, e.g., id.* § 901(a)-(c), 104 Stat. at 2700.

164. *See, e.g.*, 16 U.S.C. § 1604(g)(3)(F)(iv) (2000).

165. Chattahoochee National Forest Protection Act of 1991, 16 U.S.C. §§ 460ggg-460ggg-3 (2000).

166. Emergency Supplemental Appropriations for Additional Disaster Assistance, for Anti-terrorism Initiatives, for Assistance in the Recovery from the Tragedy that Occurred at Oklahoma City, and Rescissions Act, 1995, Pub. L. No. 104-19 §§ 1008-2002, 109 Stat. 194, 240-247 (1995). For a description of the 1995 law in the context of logging controversies in the western national forests, see KEITER, *supra* note 57, at 105-08.

167. Healthy Forest Restoration Act of 2003, 16 U.S.C.A. §§ 6501-6591 (West Supp. 2004).

168. *Id.* § 6501 (emphasis added).

169. *Id.* §§ 6511-6518.

review.[170] The HFRA illustrates how the term "health" is most susceptible to being stretched into meanings at odds with conservation priorities because it is the least tied to scientific benchmarks. For example, the Forest Service sometimes distinguishes a healthy forest from a natural forest in a way that would violate the FWS's historically based interpretation of environmental health.[171] There is solid support in the scientific literature for the need to log (mostly to thin) forests in order to reverse the adverse effects of fire suppression.[172] However, the HFRA appears to authorize activities that go far beyond the relatively noncommercial character of the controlled harvests associated with restoration of forest health.

Another post-1997 development illustrates how the Improvement Act's use of the terms "health" and "diversity" is part of a larger shift in focus for conservation legislation. In 2000, Congress amended the Pittman-Robertson Wildlife Restoration Act, also known as the Federal Aid in Wildlife Restoration Act.[173] The Pittman-Robertson Act is influential in shaping conservation priorities because it provides essential funding for state wildlife programs from a revolving fund. The 2000 amendments authorize funding for Wildlife Conservation and Restoration Programs that contain strategies to indicate the "diversity and health of wildlife."[174] The 2000 legislation also defines the conservation goal of the program in the same terms as the Improvement Act's mandatory purpose for the refuge system: maintenance of "healthy populations" through the use of "scientific" methods.[175]

CONCLUSION

Science has driven the growth and management of the refuge system to a greater extent than other dominant-use federal lands, such as the national parks. In this respect, the 1997 Refuge Improvement Act is a legislative update of longstanding principles guiding refuge

170. *Id.* §§ 6514–6516.

171. *See, e.g.*, Molly Villamana, *Commercial Activities, Invasive Species Harming National Forests, New Enviro Report Says*, LAND LETTER, June 5, 2003, at 5, ¶¶ 7–10, *at* http://www.eenews.net/Landletter/Backissues/060503/06050305.htm (last visited Nov. 12, 2004) (quoting a Forest Service official arguing that the Black Hills National Forest is in a healthy condition even though it is not a natural forest due to intensive management, extensive use, and noxious weeds).

172. William Wallace Covington, *Restoring Ecosystem Health in Frequent-Fire Forests in the American West*, 21 ECOLOGICAL RESTORATION 7 (2003).

173. Pittman-Robertson Wildlife Restoration Act, 16 U.S.C. §§ 669–669k (2000).

174. *Id.* § 669c(d)(1)(D).

175. *Compare* National Wildlife Refuge System Administration Act of 1966, 16 U.S.C. § 668ee (2000), *with* Pittman-Robertson Wildlife Restoration Act § 669a.

management. It is not a dramatic departure from the past. However, as a substantial statutory revision of the 1966 Refuge Administration Act, the 1997 Act does modify the rules of refuge management. Indeed, it binds the FWS to more criteria and standards than any other previous refuge system legislation. This is consistent with the evolution of organic legislation for federal public lands generally.

In an important sense, the 1997 Act begins a new cycle of organic act reform. At the time of its enactment, the Refuge Administration Act was the most detailed, modern federal public land organic statute. Indeed, the 1970 Public Land Law Review Commission final report contrasted the relatively comprehensive management guidance of the 1966 refuge system law with the "absence of statutory goals" for the national forests and BLM lands.[176] The 1970s brought substantial revisions to all of the other major federal land systems except the refuge system, which languished at the periphery of legal concern. In a little over a decade, the refuges went from the cutting edge to the trailing edge of organic act reforms. The 1997 Improvement Act returns the refuges to the forefront of management reforms.

No provision in the 1997 Act better exemplifies this renaissance than the mandate to maintain biological integrity, diversity, and environmental health. To turn the statutory potential into comprehensive nature conservation, the FWS will need to employ a policy that articulates measurable constraints for management. Restraint, restoration, and rejection (of refuge use requests) demand a policy that supports managers seeking to reallocate budgets and seriously examine uses.

The absence of clear textual, historical, and scientific guidance does not render the integrity-diversity-health mandate hollow. It certainly does provide the FWS with considerable room to interpret the statutory command. The integrity-diversity-health management criterion ought to help the Service meet its statutory mission to sustain and, where appropriate, restore and enhance, healthy populations of plants and animals. Therefore, an effective policy will draw a clear line separating allowed outcomes from proscribed effects. Maximum management discretion is not optimal discretion. Administrators and public land stewards need to be able to point to uniform, objective rules to justify unpopular decisions to stakeholders.[177] In drawing the line, the FWS should recognize that refuge management has always built on

176. PUBLIC LAND LAW REVIEW COMMISSION, ONE THIRD OF THE NATION'S LAND 42 (1970).

177. STEVEN L. YAFFEE, PROHIBITIVE POLICY (1982).

contemporaneous scientific conceptions of the essential attributes of nature.

There is no evidence in the legislative history that Congress sought to distinguish among or disaggregate the three terms. Yet, the terms together do not constitute a recognizable or coherent concept distinct from the meaning of the individual elements. The 2001 FWS policy on biological integrity, diversity, and environmental health defines three distinct yet largely overlapping categories. This approach satisfies the traditional canons of statutory construction. The substantive content of the administrative interpretation is congruous with much of the technical literature concerning natural resources management. Although the historic conditions benchmark for biological integrity and environmental health is a somewhat controversial application of the science literature, the overall framework is well within the Service's discretion.

Just as the history of refuge management and the larger legal landscape of natural resources law support the influence of science on the interpretation of the Improvement Act, they also suggest three trends for the future. First, though diversity and health emphasize important aspects of nature protection, integrity is becoming the broader umbrella concept. In the past decade, integrity has begun to eclipse biodiversity as a central organizing principle of ecological conservation. Both legislation and the technical literature manifest this trend. This is because the emerging consensus meaning of "integrity" encompasses all of the pieces now understood to constitute functioning landscapes.[178]

Second, the larger context of natural resources law indicates the importance of agency implementation. For instance, in the Endangered Species Act, the Clinton administration took statutory language that had been viewed as an almost insurmountable hurdle to development and reworked it as a permit program by adopting a new set of policies.[179] Even more relevant to the integrity-diversity-health criterion is the National Forest Management Act's diversity provision. The NFMA language is rife with hedge words and vague phrasings. In their magisterial study of the statute, Charles Wilkinson and H. Michael Anderson noted that "it is difficult to discern any concrete legal

178. *See* Reed F. Noss, *Some Suggestions for Keeping National Wildlife Refuges Healthy and Whole*, 44 NAT. RESOURCES J. 1093 (2004).

179. For a description of the change in the administrative interpretation of sections 9 and 10 of the ESA, see Robert L. Fischman & Jaelith Hall-Rivera, *A Lesson for Conservation from Pollution Control Law: Cooperative Federalism for Recovery Under the Endangered Species Act*, 27 COLUM. J. ENVTL. L. 45, 73–78 (2002); J.B. Ruhl, *Who Needs Congress? An Agenda for Administrative Reform of the Endangered Species Act*, 6 N.Y.U. ENVTL. L.J. 367, 384–85, 392–94 (1998).

standards on the face of the provision."[180] The same could be said of the integrity-diversity-health criterion in the Improvement Act. Yet, because its implementing regulation bound the Forest Service to maintain viable populations, the NFMA diversity provision proved to be a strong mandate. It ultimately succeeded in restraining the Forest Service's timber program and dramatically reducing the amount of logging on national forest lands.

The FWS needs the same kind of regulatory backstop to stiffen its resolve to say "no" to politically expedient but ecologically degrading uses of the refuge system.[181] The 2001 policy is a laudable start. Its "assurance" that "densities of endangered or otherwise rare species are sufficient for maintaining viable populations"[182] is not as strongly written as the 1982 Forest Service regulations. Nonetheless, it is an important start. The more strongly phrased compatibility policy bolsters the integrity-diversity-goal in prohibiting refuge uses that cause habitat fragmentation.[183] The most important struggle in meeting the integrity-diversity-health criterion will be the establishment of concrete benchmarks to identify, abate, and ultimately reverse threats to refuge ecosystems. The FWS must concentrate on developing assessments of biological integrity, diversity, and environmental health that will indicate management successes and failures on refuges.

Third, the scale of application of the integrity, diversity, and health criterion in the Act is consistent with the recent developments in the technical literature as well as in federal legislation. The strong modern trend is toward the use of broader scales to measure nature protection. Central to the criterion in the Act is the idea that the FWS should look beyond individual refuges to the aims of the entire refuge system. Another aspect of this spatial scope is management of the unit as a component in a community, watershed, or region. The temporal dimension of integrity and health addresses the dynamic variation in ecological processes through the limits of historic conditions (see Figure 1).

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180. Charles F. Wilkinson & H. Michael Anderson, *Land and Resource Planning in the National Forests*, 64 OR. L. REV. 1, 296 (1985).

181. This is the "can't-do," bottom line that Oliver Houck argues is a necessary condition for effective biodiversity law. Houck, *supra* note 51, at 871.

182. Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System, 66 Fed. Reg. 3810, 3821 (2001); U.S. FISH & WILDLIFE SERV., *supra* note 40, 601 FW 3.14(C).

183. National Wildlife Refuge System: Land Usage; Compatibility Policy, 65 Fed. Reg. 62,483, 62,486 (2000); U.S. FISH & WILDLIFE SERV., *supra* note 40, 603 FW 2.5(A). This policy provision is not part of the regulation dealing with compatibility, however. FWS Land Use Management, 50 C.F.R. § 29.1 (2003).

The 1997 Refuge Improvement Act will prove to be an important milestone in the development of conservation law. It marks the ascendancy of integrity, diversity, and health as legal interpretations of the science of nature protection.