

RECONSTRUCTING THE WALL OF VIRTUE: MAXIMS FOR THE CO-EVOLUTION OF ENVIRONMENTAL LAW AND ENVIRONMENTAL SCIENCE

BY
J.B. RUHL*

The decision-making framework established by most environmental laws incorporates an outdated Einsteinian model of how science and policy should be positioned within administrative agencies. Laws such as the Endangered Species Act employ a linear model of science and policy in which science is portrayed as operating in a domain separate from policy, the two being separated by a “Wall of Virtue” preventing agency science and scientists from becoming tainted by engagement in the relevant policy context. Far from protecting science from politics, however, this approach facilitates agency use of science as a cover for decisions based on social and economic policy agendas, and has equally exposed policy choices to the influence of scientists presenting themselves as practicing “pure science” but who in fact are pursuing issue advocacy. The politicization of science and the scientization of policy decision making have become endemic and mutually reinforcing in environmental law.

Using the Endangered Species Act as an example, this Article contends that environmental law and environmental science co-evolve in a law-science process that is continually in flux and often under stress, with the relevant question being how to manage them in unison so the process leads to sensible decisions. The Wall of Virtue should not separate science and policy—it should surround the two. The real question, therefore, is how best to design, build, and maintain it as a set of principles that foster the role of scientists as stakeholders in policy and protect the law-science process of environmental agencies as a transparent, credible, and honest undertaking.

The Article addresses that question in four stages. Part II briefly lays out the kind of law-science process transgressions that give rise to concern about the integrity of agency decision making. Part III introduces the ESA as a case study, showing how its administration

* Matthews & Hawkins Professor of Property, Florida State University College of Law, Tallahassee, Florida. I thank Lewis & Clark Law School for inviting me to participate in the Law, Science, and Environment Forum: A Meeting of the Minds Symposium, and I appreciate the many thoughtful comments other participants offered on my contribution.

involves a complex amalgam of law-science questions. Part IV outlines some general principles for agency decision-making processes designed to match the realities of the law-science process context. Using a recent example of a breakdown in ESA decision making, Part V grounds those general principles with several maxims for the exercise of agency policy discretion by agency officials responsible for the law-science interface.

I.	INTRODUCTION	1064
II.	DEFINING THE MANAGEMENT CHALLENGE: GUARDING AGAINST PROCESS TRANSGRESSIONS	1067
III.	THE ENDANGERED SPECIES ACT AS A CO-EVOLVING LAW-SCIENCE PROCESS SYSTEM.....	1068
IV.	MANAGING THE STABLE DISEQUILIBRIUM OF LAW-SCIENCE PROCESSES.....	1073
	A. <i>Integration of Science and Law as an Emergent Property</i>	1074
	B. <i>Exercising Professional Judgment at the Edge of Chaos</i>	1075
	C. <i>Regulatory Peer Review as a Disturbance Regime</i>	1076
V.	DID JULIE MACDONALD CROSS THE LINE, OR WAS SHE JUST DOING HER JOB?— MAXIMS FOR OPERATING WITHIN THE WALL OF VIRTUE.....	1078
VI.	CONCLUSION—TOWARD A NEW GENERATION OF PROFESSIONALS.....	1080

[P]ursuit of scientific truth, detached from the practical interests of everyday life, ought to be treated as sacred by every Government, and it is in the highest interests of all that honest servants of the truth should be left in peace.¹

I. INTRODUCTION

In the early hours of the morning, tucked under the covers in a cozy home not far from an elite university campus, a scientist dreams sweet dreams of life in Scienceland. There, within a compound encircled by the mighty Wall of Virtue, scientists frolic in a candy shop of labs, databases, and high speed computers, churning out research on whatever interests them. Outside the Wall of Virtue lies Policyland, a vast, verdant landscape where simple farmers grow food for the scientists, who are too busy to do so for themselves. Policyland's farmers are overseen by the policy makers, who, while being just as ignorant of science as the farmers, have learned to trade food to the scientists in return for black boxes containing findings of science the farmers need to navigate their simple lives in Policyland. Having no other source of guidance, the policy makers have instructed the farmers to follow every detail of the scientists' wisdom. While this alone brings a smile to our slumbering scientist, the topping to the sweet dream is that the scientists in Scienceland get all this while never needing to venture into Policyland.

¹ ALBERT EINSTEIN, THE WORLD AS I SEE IT 34 (Kensington Publ'g Corp. 2006) (1956) (quote from a letter Einstein wrote to Italy's Minister of State, Signor Rocco, to urge the fascist state not to interfere in scientific research).

Far from the university campus where our scientist rests, in a suburb not far from a seat of government, the head of a regulatory agency dreams a much different version of Scienceland and Policyland. In this Policyland, policy makers guide a fast, efficient society of businesspeople with wise, benevolent policies they devise in password-protected rooms deep in the basements of very large modern buildings. The policy makers have scientists as their personal assistants, whom they pepper all day long with questions about this and that. The policy makers demand immediate answers in the form of written reports the policy makers staple to their policies so that the businesspeople believe in the wisdom of the policies. The scientists are educated at the University of Sound Science behind the ivy-covered walls of Scienceland, where policy makers instruct them on such matters as the best available science and the quality of data. Best of all, when a policy maker's personal assistant scientist starts giving answers the policy maker does not like, a new graduate of the University is sure to apply for the job. This way—and this is what makes the dream so soothing—there is always a report to staple to a new policy.

Clearly, these two dreams cannot both come true in the real world, at least not at the same time. The essence of their incompatibility is this: scientists wish for policy makers to follow the findings of science, but do not wish to sully themselves with the mess of policy making; whereas policy makers wish for scientists to give them findings of science that facilitate and support policy making, but to stay out of the actual business of policy making. On one hand, there appears to be harmony between these two ideals: scientists and policy makers agree that science and policy are separate domains—that the Wall of Virtue divides Scienceland and Policyland. But here and there along the wall peep holes appear, and like workers watching the big machines at a construction site, the scientists and policy makers cannot help peering into each others' domains. Scientists seeing policy makers not following the findings of science become indignant, and policy makers seeing how scientists do their work begin to wonder whether the scientists have an "agenda." Suspicion grows on both sides of the wall, and increasingly scientists and policy makers start putting their noses into each others' business. Scientists speak out about policy. Policy makers speak out about science. Each side ponders how to put a trap door in the Wall of Virtue.

Much has been written lately in legal scholarship about the two central topics around which this saga has unfolded—the role of science in policy and the role of policy in science—and perhaps in no field of law has more been said about them than environmental law.² Yet asking the question, "What is the proper role of science in environmental policy?" is utterly misguided, in that it suggests that science operates on the other side of the

² Jim Salzman and I canvass the literature on the "sound science" debate in J.B. Ruhl & James Salzman, *In Defense of Regulatory Peer Review*, 84 WASH. U. L. REV. 1, 2–8 (2006). For a recent collection of essays on the topic, see *RESCUING SCIENCE FROM POLITICS: REGULATION AND THE DISTORTION OF SCIENTIFIC RESEARCH* (Wendy Wagner & Rena Steinzor eds., 2006) [hereinafter *RESCUING SCIENCE*].

Wall of Virtue from policy. Nathan E. Hultman, reviewing the discussion of this question found in *The Honest Broker*,³ by Roger Pielke, Jr., refers to this as the “linear model” of science in society, “whereby knowledge is created in the lab, packaged by scientific experts, and then handed off to politicians to do what they will.”⁴ The end result of this vision of science, however, is that “science has come to be viewed as simply a resource for enhancing the ability of groups in society to bargain, negotiate, and compromise in pursuit of their special interests.”⁵ But in many ways science has asked for this by demanding to be “left in peace.” In contrast to Einstein’s vision, Pielke outlines a “stakeholder model” in which “scientists-as-experts work to understand the interests of different groups and the users of knowledge themselves have some role in its production.”⁶

Environmental law, in particular, is well-suited to Pielke’s stakeholder model. As a body of law it is defined by an intersection between policy and science. The two are so entangled that it is impossible to unravel a “proper role” of one without considering the “proper role” of the other. Using the Endangered Species Act (ESA)⁷ as an example, I contend that law and science co-evolve in a law-science process that is continually in flux and often under stress, with the relevant question being how to manage them in unison so the process leads to sensible decisions.⁸ Alas, I am afraid for our slumbering scientist and policy maker that the Wall of Virtue does not *separate* Scienceland and Policyland—it *surrounds* the two. The real question, therefore, is how best to design, build, and maintain it as a set of principles that foster and protect the law-science process of environmental agencies.

This Article addresses that question in four stages. Part II briefly lays out the kind of law-science process transgressions that give rise to concern about the integrity of agency decision making. Part III introduces the ESA as a case study. Part IV outlines some general principles for agency decision-making processes designed to match the realities of the law-science process context. Part V grounds those general principles with several maxims for the exercise of agency policy discretion by agency officials responsible for the law-science interface. The consequence of this Article’s approach is that, while Einstein’s honest servants of the truth are not left in peace, they can remain committed to serving the truth as stakeholders in the agency’s law-science process.

³ ROGER PIELKE, JR., *THE HONEST BROKER: MAKING SENSE OF SCIENCE IN POLICY AND POLITICS* (2007).

⁴ Nathan E. Hultman, *To Arbitrate or to Advocate?*, 317 SCI. 900, 900 (2007) (reviewing PIELKE, *supra* note 3).

⁵ *Id.*

⁶ *Id.* (quoting PIELKE, *supra* note 3).

⁷ Endangered Species Act of 1973, 16 U.S.C. §§ 1531–44, (2000 & Supp. 2004).

⁸ For two thoughtful essays on the tension between law and science in environmental policy contexts, one from a lawyer and the other from a scientist, see Dan Tarlock, *Environmentalism: Postmodern Evangelism or Unitarianism?*, 56 CASE W. RES. L. REV. 643 (2006), and S.V. Briggs, *Integrating Policy and Science in Natural Resources: Why So Difficult*, 7 ECOLOGICAL MANAGEMENT AND RESTORATION 37 (2006).

II. DEFINING THE MANAGEMENT CHALLENGE: GUARDING AGAINST PROCESS TRANSGRESSIONS

Most people are neither lawyers nor scientists, and cannot reasonably be expected to fully appreciate the inner workings and outer merits of agency decisions about the environment. But people generally do expect certain qualities to be maintained in science and in law, and seem to have a good sense of when they have been violated.⁹ People generally expect the law to be fair when it must exercise discretion subjectively, and they expect science to be objective and rigorous.¹⁰ And people expect both law and science to be administered through transparent procedures that ensure the public can “watch” how law and science reach decisions, even if most people do not have the expertise to evaluate the merits of those decisions in strictly legal or scientific terms.¹¹ Process matters.

The problem that is at the core of the law-and-science debate in environmental policy—that is, what leads to concern when agency policy decisions about the environment inevitably depend at least in part on science—is the opportunity that exists for participants in one of the two disciplines, namely the lawyers or the scientists, to fulfill the expectations people have of their discipline while using that to justify bending the rules of the other discipline. People fear that lawyers will use the fairness virtue of law to dispense with the objectivity and transparency of science, or that scientists will use the objectivity virtue of science to dispense with the fairness and transparency of the law.¹² Nobody really wants to live in either version of the Scienceland/Policyland dream worlds.

One premise of environmental law (and of administrative law in general) is that we can reduce the chances of one discipline hijacking the other through a “checks and balances” approach:¹³ environmental laws instruct the policy people to use science in their decisions, then crowd the science people and the policy people into the same tent, called an agency, where each side will keep the other honest. What this strategy fails to account for, of course, is the worst of all possible worlds, which is when the lawyers *and* the scientists get together and decide to dispense with the virtues of *both* disciplines to advance their mutually chosen agenda.

Hence three kinds of law-science process violations can surface in the merged law-science process approach of environmental law:

- *Science? What Science?* In this scenario the policy people are interested only in fulfilling their chosen policy agenda, and if it looks as if the science will not support it, then they either do not

⁹ For some observations on public expectations of law and science, see Ann Clarke, *Seeing Clearly: Making Decisions under Conditions of Scientific Controversy and Incomplete and Uncertain Scientific Information*, 46 NAT. RESOURCES J. 571 (2006).

¹⁰ See *id.* at 579–82 (explaining the scientific process).

¹¹ See *id.* at 576–77.

¹² *Id.* at 571.

¹³ *Id.* at 577–78.

ask for the science, ignore it, “interpret” it so as to support the agenda, or point to overriding policy objectives.¹⁴

- *The Science Made Us Do It.* In this scenario the science people are interested only in fulfilling their chosen policy agenda, and they present the science in such a way as to dictate the outcome and thus override consideration of other policy objectives.¹⁵
- *Junk Science.* In the ultimate law-science conspiracy, the policy people and the science people team up on a mutually chosen agenda and “design” the science inquiry to mesh with the policy context in such a way as to lead inevitably to the chosen outcome.¹⁶

The question I am addressing is: how do we manage the law-science conglomerate of environmental agencies to minimize the occurrence of these law-science process transgressions? My central theme is that this management process is made more complicated by the reality that once we put law and science in the same tent, they co-evolve. There are no separate sleeping quarters. We are managing a law-science process system that evolves over time, and we need to get used to that concept. In the next section, I use the ESA to illustrate what I mean by this and to introduce context for the recommendations I offer.

III. THE ENDANGERED SPECIES ACT AS A CO-EVOLVING LAW-SCIENCE PROCESS SYSTEM

The ESA, our nation’s foundation for species conservation policy, is an assembly of provisions and programs steeped in law-science intersections.¹⁷

¹⁴ See generally CHRIS MOONEY, *THE REPUBLICAN WAR ON SCIENCE* (2005) (describing the use and misuse of science in politics); *RESCUING SCIENCE*, *supra* note 2. See *infra* Part IV for specific examples.

¹⁵ Pielke refers to such people as “stealth issue advocates,” one technique of whose is to present their science “claim[ing] to be acting in a nonpartisan way while simultaneously seeking to reduce society’s options.” Hultman, *supra* note 4, at 900. Similarly, UCLA geography professor Stanly Trimble suggests that “ideology, not science, ha[s] established a significant grip on the top scientific press,” and “emotionalism, exaggeration, and even ideological viciousness . . . have invaded the field of environmental science.” Stanley W. Trimble, *The Double Standard in Environmental Science*, REG., Summer 2007, at 16.

¹⁶ See, e.g., Emily Green, *Regulators to Let Maker Test Chemical Levels*, L.A. TIMES, Nov. 1, 2003, at 19 (reporting EPA decision to delegate scientific studies of herbicide atrazine to Syngenta, atrazine’s manufacturer).

¹⁷ I have had the pleasure of being asked to make presentations and write commentary for publication about the ESA several times. Out of necessity, the materials in this section are a variation—tailored for the instant purposes—of a template I have developed and used to inform readers not familiar with the ESA of the statute’s basic structure. Similar treatments appear elsewhere. See, e.g., Ruhl & Salzman, *supra* note 2, at 15–19. Like the other works, this Article is not intended to provide a comprehensive overview of the ESA. Rather, it uses the ESA in this section as a case study for understanding how the law-science process arises and evolves. For comprehensive treatments of the ESA, several of which are referred to frequently *infra*, see

The role science is supposed to play varies throughout the statute, and is influenced by the statute's policy; yet, just as much, the statute's policy is influenced by science. Three programs the Fish and Wildlife Service (FWS or the Service) and the National Marine Fisheries Service (NMFS) administer under the ESA illustrate the spectrum of different balances between the two co-evolving realms of objective science and discretionary policy:

- *Species Listing.* Section 4 of the ESA directs FWS and NMFS to identify any species "in danger of extinction throughout all or a significant portion of [their] range"¹⁸ based on threats such as predation, loss of habitat, and disease.¹⁹ The agency must make this decision "solely on the basis of the best scientific and commercial data available."²⁰
- *Critical Habitat Designation.* Section 4 of the ESA also directs FWS and NMFS, after identifying an endangered species, to designate its "critical habitat,"²¹ which are areas "essential to the conservation of the species" and "which may require special management considerations or protection."²² Unlike the listing decision, however, areas that might otherwise qualify as critical habitat using the "best scientific data available" may be excluded from designation for a variety of reasons, including national security and economic impact.²³
- *Habitat Conservation Plans.* Section 9 of the ESA prohibits "take" of listed species through such acts as hunting and, most significantly, harming a species by modifying its habitat in a way that leads to actual death or injury.²⁴ But section 10 of the ESA provides a permit

MICHAEL J. BEAN & MELANIE J. ROWLAND, THE EVOLUTION OF NATIONAL WILDLIFE LAW 194–276 (3d ed. 1997); STANFORD ENVTL. LAW SOC'Y, THE ENDANGERED SPECIES ACT (P. Stephanie Easley et al. eds., 2001); SECTION OF ENV'T, ENERGY, AND RES., AM. BAR ASS'N, ENDANGERED SPECIES ACT: LAW, POLICY, AND PERSPECTIVES (Donald C. Baur & Wm. Robert Irvin eds., 2002) [hereinafter LAW, POLICY, AND PERSPECTIVES]; LAWRENCE R. LIEBESMAN & RAFE PETERSEN, ENDANGERED SPECIES DESKBOOK (2003); and TONY A. SULLINS, ENDANGERED SPECIES ACT (2001).

¹⁸ 16 U.S.C. § 1532(6) (2000).

¹⁹ *Id.* § 1533(a)(1) (2000). For a description of the listing process, see STANFORD ENVTL. LAW SOC'Y, *supra* note 17, at 31–58; LIEBESMAN & PETERSEN, *supra* note 17, at 15–20; SULLINS, *supra* note 17, at 11–25; and J.B. Ruhl, *Section 4 of the ESA: The Keystone of Species Protection Law*, in LAW, POLICY, AND PERSPECTIVES, *supra* note 17, at 19, 19–26.

²⁰ 16 U.S.C. § 1533(b)(1)(A) (2000).

²¹ *Id.* § 1533(a)(3)(A)(i) (Supp. IV 2004).

²² *Id.* § 1532(5)(A)(i) (2000). For a description of the critical habitat designation process, see Federico Cheever, *Endangered Species Act: Critical Habitat*, in LAW, POLICY, AND PERSPECTIVES, *supra* note 17, at 47–70; STANFORD ENVTL. LAW SOC'Y, *supra* note 17, at 59–69; LIEBESMAN & PETERSEN, *supra* note 17, at 20–22; SULLINS, *supra* note 17, at 26–28; and Murray D. Feldman & Michael J. Brennan, *The Growing Importance of Critical Habitat for Species Conservation*, 16 NAT. RESOURCES & ENV'T 88, 88–89 (2001).

²³ 16 U.S.C. § 1533(b)(2) (Supp. IV 2004).

²⁴ 16 U.S.C. § 1538(a)(1) (2000). For a description of cases developing the legal standards for what constitutes "take," see LIEBESMAN & PETERSEN, *supra* note 17, at 39–46; STANFORD

program for “incidental take” of listed species.²⁵ By submitting a habitat conservation plan (HCP) and demonstrating a variety of criteria, such as adequacy of funding and efforts to minimize and mitigate the incidental take, an applicant can receive a permit from FWS and NMFS to carry out the activity so long as it will not “appreciably reduce the likelihood of the survival and recovery of the species in the wild.”²⁶ The provision imposes no particular scientific standard on the permitting decision.

Each of these programs presents opportunities for any of the three law-science process violations to take hold, because science alone cannot definitively provide the final answers and policy alone is about choosing between many answers. Science can tell us about the status of a species, but whether a species is “endangered” ultimately requires some judgment and thus opens the door to process violation problems. The critical habitat determination suffers from the same characteristic, and goes further by expressly allowing policy considerations to override the judgment drawn from the best available science. And the HCP permitting criteria lead to a mish-mash of science-based and policy-based judgments.

Indeed, the litigation history under the ESA suggests that more and more interest groups with a stake in ESA decisions believe law-science process violations of all three types are occurring, and that courts increasingly are agreeing. The first case in which a court reversed a listing decision on the merits because of a process violation did not come until 1988, when a court found that the FWS decision to defer ruling on a petition to list the northern spotted owl could not be sustained.²⁷ All of the scientific reports the agency had assembled concurred that the species was at risk of extinction, yet the agency appealed to its administrative expertise as a basis for concluding scientific uncertainty over the status remained.²⁸

The dam broke soon thereafter. In 1993, for example, I wrote that

Most litigation under the Act has involved the effects of a listing, not whether the listing should have occurred. Recently, however, through the surge in the

ENVTL. LAW SOC'Y, *supra* note 17, at 104–12; SULLINS, *supra* note 17, at 44–54; Gina Guy, *Take Prohibitions and Section 9*, in LAW, POLICY, AND PERSPECTIVES, *supra* note 17, at 191; Steven P. Quarles & Thomas R. Lundquist, *When Do Land Use Activities “Take” Listed Wildlife Under ESA Section 9 and the “Harm” Regulation?*, in LAW, POLICY, AND PERSPECTIVES, *supra* note 17, at 207; Alan M. Glen & Craig M. Douglas, *Taking Species: Difficult Questions of Proximity and Degree*, 16 NAT. RESOURCES & ENV'T 65 (2001).

²⁵ 16 U.S.C. §§ 1536(b)(4), 1539(a)(1) (2000). An incidental taking, although not the subject of a specific statutory definition provision, is described in section 10 as a taking that is “incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.” *Id.* § 1539(a)(1)(B) (2000). FWS and NOAA have adopted this meaning for purposes of the regulations implementing section 7. 50 C.F.R. § 402.02 (2006).

²⁶ For a description of the incidental take authorization procedures, see LIEBESMAN & PETERSEN, *supra* note 17, at 46–50; STANFORD ENVTL. LAW SOC'Y, *supra* note 17, at 127–73; SULLINS, *supra* note 17, at 87–102.

²⁷ *N. Spotted Owl v. Hodel*, 716 F. Supp. 479 (W.D.Wash. 1988).

²⁸ *Id.* at 483.

number of species being listed or examined for listing, and through an increasing awareness by environmentalists and industry alike of the true force of the ESA's prohibitions, the species listing process has become the focus of intensified advocacy and litigation.²⁹

The trend has continued. Since 1997, I have compiled a report of all significant cases decided under the ESA as part of the American Bar Association Section on Environment, Energy, and Resources' annual *Year in Review*,³⁰ and each year I have included more listing and critical habitat cases than in the previous year in which a court has found what amounts to a law-science process violation.³¹ Even the HCP permit program, which was not added to the ESA until 1982 and was not meaningfully implemented until the mid-1990s, has become a target of law-science process violation litigation.³²

Notwithstanding the volume of media attention and caustic references in Congress the topic of *Junk Science* violations receives, very few of these ESA cases involve a finding that the agency engaged in so blatant a law-science process transgression. As examples discussed later in this section and the next suggest, the courts generally have not questioned the legitimacy of the science identified by the agency as supporting its decision. Rather, the courts recognize that the ESA involves decisions for which science can provide only part of the answer, the question being whether the agency has accurately described how the science supports its ultimate decision. In some cases—usually instances in which the agency has decided not to list a species or designate critical habitat—the court finds a *Science? What Science?* violation in that the agency's decision noticeably departs from the direction suggested by the best available science. In other cases—usually instances in which the agency has decided to list a species or designate critical habitat—the court finds a *The Science Made Us Do It* violation in that the science points in the right direction but does not go as far to support the agency's decision as the agency suggests it does.

If one digs deep into the courts' rationales in these cases, however, it is clear that many times the cases are not about only the science or only the law. More often, they are about the law-science process, with the court instructing the agency about how the ESA as a matter of law directs the practice and use of science in agency decisions. For example, the court in *Home Builders Association of Northern California v. United States Fish and Wildlife Service*³³ recently explained several important law-science process criteria the Service must satisfy in order to properly carry out its critical habitat designation duties:

²⁹ J.B. Ruhl, *Section 4 of the ESA—The Cornerstone of Species Protection Law*, 8 NAT. RESOURCES & ENV'T 26, 26 (1993).

³⁰ See, e.g., J.B. Ruhl, *Endangered Species 2006 Annual Report*, 2007 A.B.A. SEC. ENV'T ENERGY, & RESOURCES L. 31, 31–39 (2007) [hereinafter *The Year in Review*].

³¹ 2005 was a banner year. See J.B. Ruhl, *Endangered Species 2005 Annual Report*, 2006 A.B.A. SEC. ENV'T ENERGY, & RESOURCES L. (2006).

³² See *The Year in Review*, *supra* note 30, at 38–39.

³³ 268 F. Supp. 2d 1197 (E.D. Cal. 2003).

- The Service must describe a method for determining how and when the species can be considered conserved, so it can determine whether a particular physical or biological element is essential to the conservation of the species.³⁴
- The Service must provide a particularized description of the primary constituent elements it concludes are essential to the conservation of the species, and must define objective, measurable criteria for identifying such elements.³⁵
- The Service must identify only those specific areas in which the features essential for the conservation of the species are found. In this regard, the Service may not engage in over-inclusive designations of areas not containing the essential features, intending to rely on narrative exclusion criteria and post-designation consultations under Section 7(a)(2) of the ESA to identify the specific areas that should have been excluded.³⁶
- The Service must articulate the particularized reasons why any specific area that does contain the essential features also presently requires, or in the future may require, special management considerations or protection.³⁷
- The Service must define areas occupied by the species based on direct physical evidence of occupation rather than generalized assumptions about habitat conditions or species preferences.³⁸
- The Service must acknowledge evidence in the record that conflicts with its conclusions and provide a rationale for rejecting such evidence.³⁹

Indeed, even the “best available science” standard that courses through many of the ESA programs has been distilled by the courts into a law-science process construct consisting of essential principles including:⁴⁰

- The agencies may not manipulate their decisions by “unreasonably relying on certain sources to the exclusion of others.”⁴¹

³⁴ *Id.* at 1214.

³⁵ *Id.* at 1210.

³⁶ *Id.* at 1216.

³⁷ *Id.* at 1218.

³⁸ *Id.* at 1221.

³⁹ *Id.* at 1225.

⁴⁰ See Sw. Ctr. for Biological Diversity v. Norton, No. 98-934, 2002 WL 1733618, at *8 (D.D. Cir. July 29, 2002) (summarizing the existing body of case law).

⁴¹ *Id.*

- The agencies may not disregard “scientifically superior evidence.”⁴²
- Relatively minor flaws in scientific data do not render that information unreliable.⁴³
- The agencies must use the best data available, not the best data possible.⁴⁴
- The agencies may not insist on conclusive data in order to make a decision.⁴⁵
- The agencies are not required to conduct independent research to improve the pool of available data.⁴⁶
- The agencies thus “must rely on even inconclusive or uncertain information if that is the best available at the time” of the decision.⁴⁷
- The agencies must manage and consider the data in a transparent administrative process.⁴⁸

In short, the law of the ESA is about the science of the ESA, and the science of the ESA is about the law of the ESA. The two cannot be separated, and together they have formed a co-evolving system of law-science process. One might think of the ESA as involving two separate processes in which a science process does its work, hands its output to the law process, and the law process does its work from there. But that is not at all how it works. The feedback between the two processes is continuous and complex, with each having a substantial role in defining the other. It is perhaps more useful, therefore, to think of the ESA as creating a law-science process. So the question is, what do we do with that?

IV. MANAGING THE STABLE DISEQUILIBRIUM OF LAW-SCIENCE PROCESSES

Just like its subject matter, the law-science interface in environmental laws, such as the ESA, is complex and dynamic—it evolves over time in unpredictable trajectories. Hence, just as ecology has turned increasingly to complex adaptive systems theory to enhance understanding of ecological

⁴² *Id.* (quoting *Las Vegas v. Lujan*, 891 F.2d 927, 933 (D.C. Cir. 1989)).

⁴³ *Id.* (citing *Bldg. Indus. Ass’n of Superior Cal. v. Norton*, 247 F.3d 1241, 1246–47 (D.C. Cir. 2001)).

⁴⁴ *Id.* (quoting *Bldg. Indus. Ass’n of Superior Cal.*, 247 F.3d at 1246).

⁴⁵ *Id.* at *9 (citing *Defenders of Wildlife v. Babbitt*, 958 F. Supp. 670, 680 (D.D. Cir. 1997)).

⁴⁶ *Id.* at *6, *9 (citing *Sw. Ctr. for Biological Diversity v. Babbitt*, 215 F.3d 58, 60 (D.C. Cir. 2000)).

⁴⁷ *Id.* at *9.

⁴⁸ See *N. Slope Borough v. Andrus*, 642 F.2d 589, 603 (D.C. Cir. 1980); see also *Sw. Ctr. for Biological Diversity*, 2002 WL 1733618, at *2, *6–9 (describing aspects and requirements of the ESA’s decision-making process).

processes, I have suggested that environmental law also uses complex adaptive systems theory to enhance the design and resilience of legal processes.⁴⁹ Doing so leads, I believe, to some general propositions about the law-science process as it plays out in environmental policy contexts.

A. Integration of Science and Law as an Emergent Property

Law, acting alone, would never have produced the process rules the court devised for critical habitat in the *Home Builders* case. Nor would science, on its own, have led to them. Rather, the law-science process of the ESA, as in other environmental law programs, is an emergent property. Law and science have mingled under the ESA for almost thirty-five years. The result is a process that does not make complete sense to any lawyer wearing only a law hat, or to any scientist wearing only a science hat. That is to say, the ESA's law-science process cannot be understood through the reductionist lens of law or of science alone. It has properties that do not exist in law alone or in science alone, therefore it no longer makes sense to evaluate the ESA strictly from the perspective of legal process or of science process.

Nevertheless, this is how most of the debate over the ESA is cast. One set of interests is concerned that the scientists are breaking the rules and calls for more rigorous adherence to a scientific method as a means of putting a stop to it; another set of interests is concerned that the policy makers are breaking the rules and calls for closer adherence to the precautionary principle as a means of putting a stop to it.⁵⁰ The bottom line is that everyone wants the science to come out his or her own way, but that is just not how science works, so each set of interests wants closer scrutiny of agency decisions, so long as it is on their own terms.⁵¹ The problem for both sets of interests is that no matter how you tinker with the words of the statute, the law-science process will keep chugging along, evolving through never-ending administrative rules and judicial decrees.

A current example has to do with the meaning of the phrase "all or a significant portion of its range" in the statutory definition of an endangered species, which in turn provides the essential substantive content of the Section 4 listing function—the statutory program that ostensibly is all about science and just about science.⁵² The listing function, limited as it is to using

⁴⁹ See J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean Up the Environment by Making a Mess of Environmental Law*, 34 HOUS. L. REV. 933, 980, 1000–02 (1997).

⁵⁰ I discuss these polar approaches in J.B. Ruhl, *The Battle over Endangered Species Act Methodology*, 34 ENVTL. L. 555 (2004) [hereinafter *ESA Methodology*].

⁵¹ Dr. Deborah Brosnan has found, for example, that more than 60 prominent lobbying groups representing a diverse array of interests actively supported using peer review under the ESA, but that "each group favors review of actions that it finds unpalatable. Development groups want fewer species listings and therefore demand review of listing decisions. . . . Environmental groups are concerned about habitat loss under HCPs and want them independently reviewed." Deborah M. Brosnan, *Can Peer Review Help Resolve Natural Resource Conflicts?*, 16 ISSUES IN SCI. & TECH. 32, 32–33 (2000).

⁵² 16 U.S.C. §§ 1532(6), 1533(a)(1) (2000).

the best available science, ought to provide an example of science doing its part behind the Wall of Virtue and delivering the black box for policy to adopt as is. Yet, after almost thirty-five years of administration of the statute, the meaning of this phrase is still not settled. What is “a significant portion”? What is “its range”? Are those questions of science or of policy? Indeed, one court recently described the provision as “odd phraseology” and an “enigmatic phrase.”⁵³

Perhaps that is so because the interpretation is a matter for neither science nor law acting alone to decide—sense can only be made of it as a law-science process question, and perhaps not much sense can be made of it even through that lens for very long. Indeed, there are several different judicial interpretations of the phrase on the books, and recently it took the lawyers at the Department of the Interior *nineteen single-spaced pages* of dense legal analysis, accompanied by *seventeen single-spaced pages* of probing discussion of the ESA’s legislative history, to explain to FWS what a room full of lawyers thinks this phrase means.⁵⁴ That’s more than four pages of legalese per word of the phrase, including the “a” and the “of.” One can only imagine how many pages it would take a room of scientists to define it! Of course, that is exactly what the ESA asks them to do.⁵⁵

If it takes that much firepower to figure out what “all or a significant portion of its range” means today, after thirty-five years of litigation and administration under the ESA, it strikes me as unlikely we have heard the last nuance. Rather, developments in law and in science will continue to keep the phrase in play as part of the continuing evolution of the ESA’s law-science process. And it will be difficult to straightjacket this evolution in such a way as to prevent law-process violations from ever occurring, but it may be possible to manage it in such a way as to identify true instances of law-science process failures and address them. I have two management strategies to offer as part of that undertaking.

B. Exercising Professional Judgment at the Edge of Chaos

I do not find much comfort in moving to either a scientific method model of the ESA or a precautionary principle model. The scientific method is strictly a science process designed to reach “is” answers, not “ought” answers.⁵⁶ It is not designed for policy making, and is ill-suited to it.⁵⁷ The precautionary principle, by contrast, is purely a policy process that is all about “ought.” It is designed to accept the available science and lead us to a

⁵³ *Defenders of Wildlife v. Norton*, 258 F.3d 1136, 1141 (9th Cir. 2001).

⁵⁴ See Memorandum from Solicitor, U.S. Dep’t of the Interior, to Dir., U.S. Fish and Wildlife Serv., The Meaning of “In Danger of Extinction Throughout All or a Significant Portion of its Range” (Mar. 16, 2007), available at <http://www.doi.gov/solicitor/M37013.pdf>.

⁵⁵ And they are trying. See Robin Waples et al., *A Biological Framework for Evaluating Whether a Species is Threatened or Endangered in a Significant Portion of Its Range*, 21 CONSERVATION BIOLOGY 964 (2007).

⁵⁶ See *ESA Methodology*, *supra* note 50, at 564, 573–75.

⁵⁷ See *id.* at 587, 590–91.

policy decision based on a bias against action.⁵⁸ Neither of these models really gets at the problem of law-science process violations. The scientific method has not prevented science process violations, nor can the precautionary method prevent law process violations. Therefore, injecting more of either, or both, into the ESA cannot possibly prevent law-science process violations.

Rather, I suggest we accept that science will never completely answer the questions posed in the ESA—that agencies inevitably are making decisions in a chaotic world in which information is never adequate to provide certainty, and questions about policy and science blur together. An agency must be empowered to exercise professional judgment to close the gaps.⁵⁹ Of course, because humans are behind those professional judgments, the potential for law-science process violations is always present. This puts us back at square one—what to do about the problem.

C. Regulatory Peer Review as a Disturbance Regime

Dominated as it is by administrative agency decision making, environmental law relies primarily on judicial review to police law-process violations. But courts can have a difficult time identifying instances when the lawyers or the scientists have broken the law-science process rules, because almost always they can point to faithful adherence to either the law or the science side of the system. In other words, when pressed to defend the law-science process outcome, the agency goes reductionist and focuses on how well it has implemented either the law or the science.

At one extreme, some courts, hiding behind the “judicial deference” doctrine, have opted out of digging into this problem. In one case, for example, plaintiffs alleged that a FWS decision that was supposed to be based on the best available science had been altered as it moved from the field office draft decision level to the national headquarters level, and that this change in position was the result of political influence.⁶⁰ In other words, they claimed the agency had committed a *Science? What Science?* process transgression. But the court observed that the “Field Office of the FWS could have just as easily have been motivated by political pressure as the national FWS office,”⁶¹ and in the absence of more than a change in position as evidence of such a breakdown in the law-science process at the national level, rather than a correction of field level transgressions by the national office, the court would not venture further into the issue.⁶²

At the opposite extreme are courts that go into excruciating levels of detail to sort through the law-science process history of the agency decision.

⁵⁸ INTERPRETING THE PRECAUTIONARY PRINCIPLE 17–18 (Tim O’Riordan & James Cameron eds., 1994).

⁵⁹ See *ESA Methodology*, *supra* note 50, at 578–84, 599–600.

⁶⁰ *Save Our Springs Alliance v. Cooke*, No. A-01-CA-855-SS, 2002 WL 31757473 (W.D. Tex. Nov. 12, 2002).

⁶¹ *Id.* at *7.

⁶² *Id.* at *6.

By matching up the science to the law through this fine level of analysis, courts have purported to detect instances of law-science process failures involving the agency departing from the science or stretching it too far. For example, in one piece of the sprawling Klamath River Basin litigation, a federal district court detailed numerous bits of recent evidence it considered contrary to the scientific evidence the Bureau of Reclamation, FWS, and NOAA used to support a 2002 biological opinion regarding river flows.⁶³ In virtually all official documents discussing any of this new body of evidence, NOAA claimed that the information “is not sufficient to warrant changing the conclusions reached in the 2002 biological opinion.”⁶⁴ The court worked through each such instance, however, and found the agency lacked a basis for reaching that conclusion.⁶⁵ In other words, the court concluded the agency had committed a *Science? What Science?* transgression.

By contrast, the Ninth Circuit recently held that the FWS improperly listed a population of the pygmy owl in Arizona as an endangered species.⁶⁶ In a complicated evaluation of the evidence, the court ruled that the agency overstated the significance of the population of the species in Arizona to the species as a whole.⁶⁷ The science was not “bad science,” the agency simply overstated the support it lent to the policy decision.⁶⁸ In other words, this was a case of a *The Science Made Us Do It* transgression.

Even assuming courts that engage in this level of analysis regularly get it right, it is highly questionable whether relying exclusively on judicial review is the most effective way to police law-science process violations. How many law-science process violations do not make it to litigation, and how many evade judicial detection? We do not know, but it would help if there were a mechanism to police the problem earlier than at judicial review.

In science that mechanism is called peer review. In work I have devoted to the ESA context, as well as in work Jim Salzman and I have devoted to broader administrative law contexts, I have explored the role peer review could play in helping the law-science process remain transparent and legitimate.⁶⁹ Scientific peer review applies rigorous, independent assessment of the design and execution of scientific research.⁷⁰ Likewise, regulatory peer review, which could be conducted by a panel of scientists and policy experts, would apply rigorous, independent assessment of an agency’s use of science in reaching a policy decision. Did the agency consider the relevant body of science—i.e., did it commit a *Science? What Science?* violation? Did the agency overstate the support the relevant body of science provides for the policy decision—i.e., did it commit a *The Science Made Us Do It* violation? To be sure, there are the mechanics to be worked out. For example, perhaps

⁶³ Pac. Coast Fed’n of Fishermen’s Associations v. U.S. Bureau of Reclamation, No. Civ. C02-2006 SBA, 2006 WL 798920, at *2 (N.D. Cal. May 27, 2006).

⁶⁴ *Id.* at *6.

⁶⁵ *Id.* at *4–5.

⁶⁶ Nat’l Ass’n of Home Builders v. Norton, 340 F.3d 835, 838 (9th Cir. 2003).

⁶⁷ *Id.* at 844–52.

⁶⁸ *Id.* at 847.

⁶⁹ See Ruhl & Salzman, *supra* note 2, at 43–53.

⁷⁰ See *id.* at 52–53.

random peer review would suffice to detect “rogue” agencies and to deter other agencies from slacking in their law-science process implementation.⁷¹ But these clearly are healthy questions to ask of agencies—they keep tabs on an agency’s co-evolution of law-science process and serve to disrupt any tendency to drift toward process decay, and they are best asked contemporaneously with the agency’s decision, not years later in a courtroom.

V. DID JULIE MACDONALD CROSS THE LINE, OR WAS SHE JUST DOING HER JOB?—
MAXIMS FOR OPERATING WITHIN THE WALL OF VIRTUE

Taking this conception of agency law-science processes a step further, by what set of principles should policy and science engage within the agency? In short, how must the persons ultimately responsible for exercising professional judgment do so in mixed law-science process contexts?

This question has recently been brought to a head by the investigation of allegations that Julie MacDonald, when serving as Deputy Assistant Secretary for Fish, Wildlife, and Parks at the Department of the Interior, “bullied, insulted, and harassed the professional staff of the U.S. Fish and Wildlife Service (FWS) to change documents and alter biological reporting regarding the Endangered Species Program.”⁷² According to the results of the Interior Department investigation, MacDonald, who at the time had no formal education in natural sciences, had “been heavily involved with editing, commenting on, and reshaping the Endangered Species Program’s scientific reports from the field.”⁷³ “MacDonald said she views her involvement in the Endangered Species Program as part of her duties, and she challenges the science produced by FWS field personnel and makes them accountable for the citations and rules they refer to in field reports,”⁷⁴ whereas numerous scientists in the agency perceived her behavior—particularly her direct contact with field-level agency scientists—as inappropriate.⁷⁵ The investigation found that MacDonald committed no illegal acts in this regard,⁷⁶ but it reached no conclusions with regard to whether her behavior was an appropriate exercise of her duties.⁷⁷

⁷¹ See *id.* at 54–61.

⁷² OFFICE OF INSPECTOR GEN., DEP’T OF THE INTERIOR, REPORT OF INVESTIGATION OF JULIE MACDONALD 2 (2007) (here in after MACDONALD REPORT).

⁷³ *Id.*

⁷⁴ *Id.* at 17.

⁷⁵ See *id.* at 4–16.

⁷⁶ See *id.* at 2.

⁷⁷ Leaked copies of the investigation report began to circulate in early April 2007. See Erik Stokstad, *Appointee “Reshaped” Science, Says Report*, 316 SCI. 37 (2007). Ms. MacDonald resigned from her position on April 30, 2007, and several days later Department of the Interior officials testified in Congress that the Department is committed to “the integrity of science.” See *Interior Commits to “Integrity of Science” In Aftermath of Appointee’s Resignation*, Daily Env’t Rep. (BNA) A-10 (May 10, 2007).

Did Julie MacDonald cross the line or was she just doing her job? On the one hand, science produced within an agency by field personnel cannot be treated as sacrosanct, immune from scrutiny by non-science personnel responsible for using science (and other factors) in the exercise of professional judgment. Agency decision makers have a responsibility to ensure the science upon which they base decisions is reliable and to detect *The Science Made Us Do It* process transgressions. On the other hand, if in doing so the decision makers supplant the scientists and take over the job of producing the science, they have become the problem with regard to the reliability of the agency's law-science process. The concern in such instances is that the science has been conformed to desired policy outcomes in *Science? What Science?* process transgressions.

You can decide for yourself whether Julie MacDonald crossed the line. My suggestion is that three maxims ought to guide that determination:

Maxim One. Regardless of their scientific training, it is the responsibility of agency personnel exercising the agency's professional judgment to rigorously examine and review the science that agency scientists produce in the course of their work on the relevant decision.

Maxim Two. Regardless of their scientific training, it is inappropriate for agency personnel exercising the agency's professional judgment unilaterally to alter the science that agency scientists produce in the course of their work on the relevant decision.

Maxim Three. When agency personnel exercising the agency's professional judgment disagree with the science that agency scientists produce in the course of their work on the relevant decision, changes to the science are justified only if conclusively supported by the findings of an independent, external peer review process.

The objective of this framework is to allow agency decision makers to engage agency scientists, even to question and disagree with the science the latter produce, but to leave it entirely to accepted science processes to break any stalemate. Science must remain science, but policy must have a seat at the table. This framework also accommodates situations in which the science is inconclusive and in which the science is only one of several factors that enter the professional judgment decision calculus. These are precisely the situations that mandate the exercise of professional judgment.

So, did Julie MacDonald violate any of these maxims? Based strictly on the information contained in the investigation report, she clearly satisfied Maxim One, albeit in a manner that was by all accounts extremely combative and likely corrosive to the integrity of the agency's law-science process. It also appears that she did not violate Maxim Two, although she came as close to doing so as one possibly could without crossing the line.

If the investigation report is accurate, however, she clearly violated Maxim Three. The report recounts numerous instances where MacDonald ordered that reports be altered or insisted on the integration of scientific information that she independently collected.⁷⁸ There is no evidence in the report to suggest she commissioned anything remotely like independent, external peer review to resolve differences between her and the field scientists. Such behavior appropriately rejects the fiction that a Wall of Virtue separates agency science and policy, but inappropriately erodes the ideal of a Wall of Virtue surrounding the agency's law-science process. The consequence of such behavior, when revealed, should be outrage. In MacDonald's case it led to an unraveling of agency decisions made under her oversight.⁷⁹

VI. CONCLUSION—TOWARD A NEW GENERATION OF PROFESSIONALS

I have suggested that we stop thinking of either "science and the ESA" or "the law of the ESA" and recognize instead that laws like the ESA are about a merger of law and science that is so complex it can only be thought of as a law-science process. This approach reflects the trend in legal and scientific disciplines in general. Training in environmental law increasingly exposes students to scientific disciplines. For example, Professor Dan Rohlf offers the following class at Lewis & Clark College of Law:

Law, Science, and Environment Seminar. This seminar examines the often rough intersection between law and science in managing and conserving the environment. Using a variety of federal environmental and natural resources statutes as examples, it explores processes involved in setting regulatory standards, making findings involving science, and adapting to new information and changing circumstances. It also examines specific statutes and topics such as the Data Quality Act, OMB peer review mandates, scientists as advocates, and the media and science.⁸⁰

⁷⁸ See MACDONALD REPORT, *supra* note 72, at 4–5.

⁷⁹ The fallout through this writing has been swift and decisive. In July 2007, the Fish and Wildlife Service announced it would review eight species listing and critical habitat designation decisions made under MacDonald's supervision. See News Release, Office of Public Affairs, U.S. Fish & Wildlife Serv., U.S. Fish and Wildlife Service to Review 8 Endangered Species Decisions (July 20, 2007), <http://www.fws.gov/news/NewsReleases/showNews.cfm?newsId=E54AFD13-CC75-4E83-9780C462E13BA6E2> (last visited Nov. 18, 2007). In August 2007, Judge Gladys Kessler of the D.C. federal district court ordered the agency to inform the court "what action, if any, the Department will take regarding the involvement of Julie MacDonald in the designation of critical habitat for the Canada lynx." *Defenders of Wildlife v. Norton*, Civ. A. No. 04–1230 (D.D. Cir., August 27, 2007) (order to the Department of the Interior). Shortly thereafter, the Center for Biological Diversity announced plans to sue the agency over 55 decisions it believes were subject to MacDonald's influence. See Mike Ferullo, *Environmental Organization Seeks to Reverse 55 Species Decisions Made by Administration*, Daily Env't Rep. (BNA) No. 167, at A-1 (Aug. 29, 2007).

⁸⁰ Lewis & Clark Law School, *Law, Science and Environment Seminar*, <http://www.lclark.edu/dept/lawreg/law562.html> (last visited Nov. 18, 2007).

And Professor Craig Pease offers the following course at Vermont Law School:

Ecology and Environmental Sciences. Dioxin, global climate change, extinction, and human ecology are the central case studies, used to explicate both the fundamental principles of ecology and key aspects of scientific thinking. In this course students will learn abstract principles for critiquing and analyzing scientific information generally, and will apply these principles to the preceding case studies.⁸¹

Similarly, the trend in schools of the environment is to include a substantial focus on law and policy processes. The UC-Santa Barbara Bren School of Environmental Science and Management offers several such courses:

Environmental Law and Policy. Basic elements of the legal system as it specifically relates to environmental issues. Study of the different stages and different institutions involved in environmental policy making.⁸²

Environmental Institutions: Rights, Rules, And Decision-Making Systems. Comparative study of management systems or regimes addressing natural resources and environmental concerns and operating at scales ranging from local to global. Topics include characterization of individual regimes and factors affecting the formation, evolution, and effectiveness of these institutional arrangements.⁸³

As does Duke's Nicholas School of the Environment and Earth Sciences:

Public Policy Development and Analysis for Environmental Professionals. Much of an environmental professional's career is centered on analyzing, designing and implementing environmental policies. To be effective, it is important to understand the origin of those policies. It is necessary to be familiar with how the policy agenda is set, to know which actors within and outside of government have roles in the policy development process, and to confront the political and economic context in which policies are designed and enacted. Finally, it is important to be familiar with the tools of policy analysis and to understand how policy decisions are made.

In this course students will learn about each of these topics through a process of active learning. Class participation and role-playing will be important tools. In the first part of the course students will examine the context for policy development through text readings and case studies. Students will then learn

⁸¹ Vermont Law School, *Course Descriptions*, <http://www.vermontlaw.edu/academic/acadegcou.cfm?exe=choice&id=1> (last visited Nov. 18, 2007).

⁸² Univ. of Cal., Santa Barbara, Donald Bren School of Env'tl. Sci. & Mgmt., ESM 207 – Environmental Law and Policy, <http://www.bren.ucsb.edu/academics/course.asp?number=207> (last visited Nov. 18, 2007).

⁸³ Univ. of Cal., Santa Barbara, Donald Bren School of Env'tl. Sci. & Mgmt., ESM 248 – Environmental Institutions, <http://www.bren.ucsb.edu/academics/course.asp?number=248> (last visited Nov. 18, 2007).

how to conduct policy analysis and have an opportunity to examine local environmental policy issues as the classroom becomes a forum for public debate and students play roles as analysts and advocates on two sides of an issue. Finally, students will analyze a set of environmental policy alternatives and present their findings in a summary memo to a decision maker.⁸⁴

We do not need to all become lawyer-scientists, but the trend toward training each discipline about the other is encouraging. Indeed, the Bren School began only in 1991, with a mission based on the recognition that

[w]ith [a] more integrated view of the environment came the need for a new kind of solution-oriented environmental professional, one who would be highly trained in the quantitative, multidisciplinary analysis of environmental problems and combine expertise in a range of methodologies with a solid understanding of the political, economic, and social dimensions of environmental decision-making.⁸⁵

This perspective suggests environmental professionals of the next generation will be more adept at working in law-science process contexts. It suggests they will stop asking about how to put “sound science” in the ESA and other environmental laws, and focus more on the integrated law-science process. It suggests they will not dream of a Wall of Virtue separating law and science, but build a Culture of Virtue that encompasses both disciplines through rigorous, transparent exercise of scientific objectivity and policy discretion.

⁸⁴ Duke Univ., Nicholas School of the Env'tl. and Earth Sciences, *Nicholas School Courses*, <http://www.nicholas.duke.edu/programs/courses/environ29843.html> (last visited Nov. 18, 2007).

⁸⁵ Univ. of Cal., Santa Barbara, Donald Bren School of Env'tl. Sci. & Mgmt., *About Bren-History*, http://www.bren.ucsb.edu/about/about_history.html (last visited Nov. 18, 2007).