

CLIMATE CHANGE AND THE ENDANGERED SPECIES ACT:
BUILDING BRIDGES TO THE NO-ANALOG FUTURE

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Abstract

This Article examines the challenges global climate change presents for the Endangered Species Act (ESA) and its primary administrative agency, the U.S. Fish and Wildlife Service (FWS). Climate change will reshuffle ecological systems in ways that will defy prediction using existing knowledge and models, posing threats to species through primary and secondary ecological effects and the effects of human adaptation to climate change. Even assuming global-wide regulation of greenhouse gas emissions eventually yields a more stable climate variation regime, it will differ from the recent historical regime and many species will not survive the transition regardless of human interventions using the ESA. Yet many other species can survive with the assistance offered through a focused application of the ESA.

The Article proposes a policy approach aimed toward that objective. Part I introduces the climate change challenge facing the FWS and explains why, after the Supreme Court's decision in Massachusetts v. EPA, the agency must develop a response. Part II examines the likely ecological consequences of climate change, for which we have no analog, and develops a typology of threats species will experience. Part III explores the pressures climate change will place on FWS policy decisions as increasingly more species face increasingly more serious imperilment as a result of climate change. Part IV methodically probes the relevant provisions of the ESA to identify the range of policy discretion the FWS has in making those decisions. Part V then lays out a plan for the FWS to use the ESA to build bridges for climate-threatened species across the climate change transition and into the no-analog future. Most significantly, I propose that the ESA not be used to regulate greenhouse gas emissions, but rather that it be focused on establishing protective measures for species that have a chance of surviving the climate change transition and establishing a viable population in the future climate regime. In particular, the ESA can help ensure that human adaptation to climate change does not prevent other species from adapting as well.

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I. INTRODUCTION

The pika is toast. More specifically, the American pika (*Ochotona princeps*) is running out of places to live,¹ and global climate change appears to be the primary cause of its decline.² This tiny rabbit-like species has the unfortunate trait of being remarkably well-adapted to the cold high-altitude montane habitat of the Sierra Nevada and Rocky Mountain ranges in the North American Great Basin. Indeed, it is considered one of the iconic species to people who enjoy climbing in high elevations—it even has its own fan club.³ The pika’s problem is that as global climate change causes surface temperatures to rise, the altitude below which pikas cannot find suitable conditions for survival also is rising. In Yosemite National Park, for example, researchers have determined that minimum average altitude for pika populations has risen from 7,800 feet to 9,500 feet in the past 90 years. Of course, if you think of a mountainous topography, you can quickly appreciate the pika’s problem—most remaining pika populations are now stranded on scattered high mountain peaks in ranges separated by low-lying deserts, meaning they are stuck on mountaintop islands and the water is rising, so to speak. Nine of the

¹ The background on the pika in this paragraph is derived from Donald Grayson, *A Brief History of Great Basin Pikas*, 32 J. BIOGEOGRAPHY 2103 (2006), and Erik A. Beever et al., 84 J. MAMMALOGY 37 (2003). For numerous images of pikas in their montane habitat, enter “pika” in Google Images.

² In this Article I unapologetically adopt the premise that global climate change is occurring at anomalously rapid rates compared to historical trends, and that anthropogenic (human-induced) sources of greenhouse gases (primarily carbon dioxide) are a significant causal factor. I do not endeavor here to attempt to convince anyone of this. The Intergovernmental Panel on Climate Change (IPCC), an international scientific project representing hundreds of scientists, has produced a series of reports, including a comprehensive set in 2007, synthesizing scientific information on climate change and its effects on ecological conditions, all of which support the premises adopted herein. *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP I CONTRIBUTION TO THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE FOURTH ASSESSMENT REPORT, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, SUMMARY FOR POLICYMAKERS (2007) [hereinafter PHYSICAL SCIENCE BASIS SUMMARY]; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP II CONTRIBUTION TO THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE FOURTH ASSESSMENT REPORT, CLIMATE CHANGE 2007: CLIMATE CHANGE IMPACTS, ADAPTATION, AND VULNERABILITY, SUMMARY FOR POLICYMAKERS (2007) [hereinafter CLIMATE CHANGE IMPACTS SUMMARY]; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, WORKING GROUP III CONTRIBUTION TO THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE FOURTH ASSESSMENT REPORT, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS (2007) [hereinafter MITIGATION SUMMARY]; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC TECHNICAL PAPER V, CLIMATE CHANGE AND BIODIVERSITY (2002) [hereinafter CLIMATE CHANGE AND BIODIVERSITY], *all available at* <http://www.ipcc.ch> (last visited July 24, 2007). [add synthesis report when released in November 2007]

To be sure, the IPCC reports recognize a substantial degree of uncertainty about climate change cause and effect in many respects, which I cover where relevant *infra*. There are also many sources of commentary about climate change taking positions contrary to those adopted in the IPCC reports and this Article, suggesting that climate change is not occurring, or that if it is occurring, it is a natural and temporary cycle of climate variation. *See, e.g.*, CO2 Science, *CO2 Science*, available at <http://www.co2science.org> (last visited July 18, 2007). On the other hand, there are also many scientists who believe the IPCC has been too cautious in communicating the potential severity of climate change and its effects. *See* Richard A. Kerr, *Pushing the Scary Side of Climate Change*, 316 SCIENCE 1412 (2007); Chris Huntington and Jason Lowe, “Overshoot” *Scenarios and Climate Change*, 316 SCIENCE 829 (2007). Being the product of international consensus, moreover, it is widely regarded that the assessments in the IPCC reports were “watered down.” *What the Climate Panel Didn’t Say*, THE ENVTL. FORUM, May-June 2007, at 20, 20. Ongoing research the federal government’s Climate Change Science Program (CCSP) conducts, as well as U.S. government involvement in the IPCC project, is covered at www.climatechange.gov (last visited July 25, 2007).

³ *See* Pika Works, *About Pika Works*, <http://www.pikaworks.com/about/index.html> (last visited June 18, 2007).

25 historically described pika populations in the Great Basin have gone extinct and those remaining are in decline.

The pika's recent decline and gloomy future call to mind the protective capacity of the Endangered Species Act (ESA).⁴ Often referred to as the "pit bull" of environmental laws,⁵ the ESA erects a powerful framework for the identification and conservation of endangered and threatened species.⁶ The United States Fish & Wildlife Service (FWS), which administers the ESA for terrestrial and freshwater species,⁷ has identified over 1250 animal and plant species in the United States for protection and has exercised its regulatory authority throughout the nation to fulfill the statute's goal of conserving imperiled species.⁸ While few species brought under the ESA's protection have recovered to full health, the ESA is credited with preventing the vast majority of protected species from ultimate extinction.⁹

Given the threat climate change poses to the pika and potentially many other species—one preeminent ecologist describes climate change as "a major threat to the survival of species and integrity of ecosystems worldwide"¹⁰—it seems an appropriate target for the ESA. Indeed, although clearly not enthusiastic about the prospect, the FWS appears ready to carry the ESA into the climate change era, having recently proposed to extend ESA protection to the polar bear because of diminishing ice habitat upon which the species depends for survival.¹¹ The agency is

⁴ Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884 (codified as amended at 7 U.S.C. § 136, 16 U.S.C. §§ 1531–44, and in other scattered sections of 16 U.S.C.).

⁵ See, e.g., Steven P. Quarles, *The Pit Bull Goes to School*, THE ENVTL. F., Sep.-Oct. 1998, at 55 (discussing the origins of this reputation). Quarles provides additional historical context for the statute's "overbearing statutory certainty" in Steven P. Quarles and Thomas R. Lundquist, *The Pronounced Presence and Insistent Issues of the ESA*, NAT. RESOURCES & ENV'T, Fall 2001, at 59.

⁶ This Article is not intended to provide a comprehensive overview of the ESA. Rather, it focuses on the manner in which global climate change will influence administration of the ESA. For comprehensive treatments of the ESA, several of which are referred to frequently *infra*, see MICHAEL J. BEAN & MELANIE J. ROWLAND, THE EVOLUTION OF NATIONAL WILDLIFE LAW (3d ed., 1997); ENDANGERED SPECIES ACT: LAW, POLICY, AND PERSPECTIVES (Donald C. Baur & Wm. Robert Irvin eds., 2002) [hereinafter LAW, POLICY, AND PERSPECTIVES]; LAWRENCE R. LIEBESMAN AND RAFE PETERSEN, ENDANGERED SPECIES DESKBOOK (2003); STANFORD ENVTL. LAW SOC'Y, THE ENDANGERED SPECIES ACT (2001); TONY A. SULLINS, ESA: ENDANGERED SPECIES ACT (2001); THE ENDANGERED SPECIES ACT AT THIRTY VOL. 1: RENEWING THE CONSERVATION PROMISE (Dale Goble et al. eds. (2006) [hereinafter THE ENDANGERED SPECIES ACT AT THIRTY].

⁷ The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) (also known as NOAA-Fisheries) administers the ESA for most marine species and anadromous fish. My principal focus is on FWS and terrestrial and freshwater species. What is observed in this Article about the ESA, however, applies equally to administration of the statute by the NMFS.

⁸ See U.S. Fish & Wildlife Serv., *The Endangered Species Program*, <http://www.fws.gov/endangered/> (last visited June 18, 2007).

⁹ See J. Michael Scott et al., *By the Numbers*, in THE ENDANGERED SPECIES ACT AT THIRTY, *supra* note ___, at 14, 29-32.

¹⁰ Philip E. Hulme, *Adapting to Climate Change: Is There Scope for Ecological Management in the Face of a Global Threat?*, 42 J. APPLIED ECOLOGY 784 (2005). The basis for this assessment is covered extensively *infra* in Part II.

¹¹ See U.S. Fish & Wildlife Serv., Proposed Rule to List the Polar Bear (*Ursus maritimus*) as Threatened Throughout Its Range, 72 Fed. Reg. 1064 (Jan. 9, 2007). The agency proposed the rule based on a citizen petition for rulemaking. Also acting on a petition, the FWS recently initiated a status review of ten species of penguins based on threats including climate change impacts. See U.S. Fish & Wildlife Serv., 90-Day Finding on a Petition to List 12 Penguin Species as Threatened or Endangered under the Endangered Species Act, 72 Fed. Reg. 37695 (July 11, 2007). NMFS has identified several coral species for ESA protection based in part on the effects of global climate

getting strong nudges from the outside as well, as Members of Congress have urged the agency to evaluate the effects of climate change on species generally,¹² environmental advocacy groups have petitioned the agency to promulgate rules to address climate change,¹³ and one court has admonished the agency for failing to take climate change into account in its regulatory programs.¹⁴

Practically speaking, however, what can the ESA do for the pika or the polar bear? The ESA takes a species-specific approach that has proven effective when employed to address discrete human-induced threats to species that have straightforward causal connections, such as clearing of occupied habitat for development or damming of a river.¹⁵ That is not the pika's or the polar bear's situation. Rather, *all* anthropogenic sources of greenhouse gases throughout the planet, from a small farm to a sprawling refinery, are contributing to the demise of the pika and polar bear, and the species' decline in both cases is gradual and largely invisible to human perception. The causal chain is less direct than, say, a salmon that finds a dam in its way. Pikas and polar bears will not drop dead because of exposure to greenhouse gas emissions—the species will just fade away as their habitats transform below their feet. The ESA has proven to be unwieldy when applied on large working landscape levels,¹⁶ so is there reason to believe it will be any more effective when applied on global levels to this kind of creeping oblivion?

The pika and polar bear thus serve as examples of the tension global climate change will throw into administration of the ESA and other environmental laws. On the one hand, the case for bringing these and other climate-threatened species under the ESA's protective wings seems as unequivocal as they come, regardless of whether greenhouse gas emissions contribute to the climate change effects. On the other hand, given the reasonably anticipated trajectory of global climate change and its effects on ecosystems, there soon may be no practical way to administer

change. See National Oceanic and Atmospheric Administration, Final Listing Determination for Elkhorn Coral and Staghorn Coral, 71 Fed. Reg. 26852 (May. 9, 2006).

¹² See *Appropriators Urge Interior to Deepen Review of How Global Warming is Affecting Species*, 38 Env't Rep. (BNA) 1015 (2007).

¹³ See Center for Biological Diversity, Petition for Rulemaking to Amend Federal Regulations to Enhance the Recovery of Endangered Species and Address the Growing Impacts of Global Warming on Imperiled Species (Feb. 1, 2007) (copy on file with author) [hereinafter Petition for Rulemaking]; see also *Environmental Groups Seek Federal Action with Rules on Effects of Global Warming*, 38 Env't Rep. (BNA) 308 (2007) (news report of filing of Petition for Rulemaking).

¹⁴ See *Natural Resources Defense Council v. Kempthorne*, 2007 WL 1577896 (E.D. Cal. May 25, 2007) (“FWS acted arbitrarily and capriciously by failing to address the issue of climate change.”) (discussed *infra*).

¹⁵ See Barton H. Thompson Jr., *Managing the Working Landscape*, in THE ENDANGERED SPECIES ACT AT THIRTY, *supra* note __, at 101, 104 (the ESA “has had the greatest impact on active changes in species habitat (e.g., the construction of new subdivisions, timber harvesting, and water diversions)”). The seminal ESA case and icon of preservationism in American environmental law involved a dam. See *Tennessee Valley Authority (TVA) v. Hill*, 437 U.S. 153 (1978). In that case the Court halted the construction of a nearly completed federally-financed dam project because the federal agencies involved had not complied with the ESA. When asked to refuse to enjoin the construction as a matter of equity and common sense, the Court found that the ESA “admits of no exception” and “indicates beyond doubt that Congress intended endangered species to be afforded the highest of priorities.” *Id.* at 173-74. The Court refused to “make such fine utilitarian calculations” given that “Congress viewed the value of endangered species as ‘incalculable.’” *Id.* at 187.

¹⁶ See Barton H. Thompson Jr., *Managing the Working Landscape*, in THE ENDANGERED SPECIES ACT AT THIRTY, *supra* note __, at 101, 104-126; A Dan Tarlock, *The Dynamic Urban Landscape*, in THE ENDANGERED SPECIES ACT AT THIRTY, *supra* note __, at 127, 127-32.

the ESA in its present form for those species. As the authors of one environmental law casebook described the dilemma:

Are the ESA's rationales dwarfed by the current reality of global climate change? If it were possible to show that over the next century as many as half of all endangered species were likely to be rendered extinct by global warming, a condition that appears to be human-augmented but quite impervious to legal liability, would the ESA become an obsolete footnote or continue to be a practicable tool, a worthwhile declaration of principle, and a utilitarian canary in a coal mine?¹⁷

If what threatens the pika's survival also threatens the ESA's usefulness, these questions are not just for academic discourse. A "worthwhile declaration of principle" that has no practicable means of implementation would present quite a predicament for FWS. And yet it is not situation the agency can easily avoid, as the ESA contains a citizen petition procedure requiring the agency to consider species for protection¹⁸ and a citizen suit provision allowing private attorney general actions to enforce the statute.¹⁹ If past experience is any indication, petitions to protect species based on global climate change effects will begin to flow stonger, citizen suits will push hard on the agency to use the ESA's regulatory power to attack greenhouse gas emissions, and other suits will be filed to object if the agency attempts to do either.²⁰

The ESA is by no means unique in finding itself between a rock and a hard place due to climate change. For example, the Environmental Protection Agency (EPA) recently denied a citizen rulemaking petition asking the agency to regulate greenhouse gas emissions from motor vehicles as an air pollutant under the Clean Air Act.²¹ The agency dismissed the petition on the basis that global climate change is so complicated either Congress did not provide for greenhouse gas emissions to be subject matter for the Clean Air Act or, if Congress did so provide, the agency properly identified conflicting policy concerns as a basis for deciding not to regulate emissions.²²

Indeed, EPA's reasoning might have been attractive to the FWS and other regulatory agencies hoping to avoid the myriad of difficult policy issues surrounding climate change: Congress could not have meant for them to incorporate the ubiquitous, complex dynamics of global climate change into each and every discrete regulatory program, and even if Congress did have that in mind, the broad discretion agencies usually enjoy under regulatory statutes provides enough wiggle room to dodge the bullet. The agencies are off the hook. The pika can fend for itself.

But the Supreme Court has nipped this kind of reasoning in the bud. In *Massachusetts v. EPA*,²³ a majority of the Court found that the EPA erred in denying the rulemaking petition,

¹⁷ ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 783 (3d ed. 2004).

¹⁸ 16 U.S.C. § 1533(b)(3). *See infra* text accompanying notes ___-___.

¹⁹ 16 U.S.C. § 1540(g). *See infra* text accompanying notes ___-___.

²⁰ For example, citizen petitions, frequently followed by citizen suits, have been a major force behind the identification of species for ESA protection. *See* D. Noah Greenwald et al., *The Listing Record, in THE ENDANGERED SPECIES ACT AT THIRTY*, *supra* note ___, at 51, 54-63.

²¹ *See* U.S. Environmental Protection Agency, Control of Emissions from New Highway Vehicles and Engines, 68 Fed. Reg. 52922 (Sept. 8, 2003).

²² *Id.* at 52929-31.

²³ 127 S. Ct. 1438 (2007).

making clear the principle that simply because Congress did not have climate change on its mind when it drafted a law does not mean thirty or however many years later the agency responsible for implementing the law can ignore the effects of climate change.²⁴ Like any other phenomenon that comes along after a statute is enacted, if global climate change becomes relevant to the statutory text and policy, it is fair game, if not *mandatory* fodder, for incorporation into the regulatory program. Hence, the Court concluded, greenhouse gas emissions, because they are linked to climate change and its numerous anticipated ill effects,²⁵ fit the Clean Air Act's broad definition of an air pollutant.²⁶ As the Court put it, "while the Congress that drafted [the Clean Air Act] might not have appreciated the possibility that burning fossil fuels could lead to global warming, they did understand that without regulatory flexibility, changing circumstances and scientific developments would soon render the Clean Air Act obsolete. The broad language [of the statute]...reflects an intentional effort to confer the flexibility necessary to forestall such obsolescence."²⁷

From that point, the Clean Air Act charged the EPA with regulating greenhouse gas emissions from motor vehicles if in EPA's "judgment [the emissions] cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare."²⁸ Noting that the Clean Air Act defines "welfare" to include "effects on...weather...and climate," the Court rejected the EPA's proffered bases for its judgment not to regulate greenhouse gas emissions. The EPA had taken the position that, even if it had authority to treat greenhouse gas emissions as a pollutant, it would exercise its discretion not to do so in order to accommodate "other priorities of the Administrator or the President," such as facilitating the President's flexibility to negotiate with other nations on climate change.²⁹ These other priorities, however, were not within the scope of the agency's discretion under the Clean Air Act. Rather,

[u]nder the clear terms of the Clean Air Act, EPA can avoid taking further action [to regulate carbon emissions from motor vehicles] only if it determines that greenhouse gases

²⁴ For a concise yet thorough summary of the rulemaking petition, the EPA's decision, lower court proceedings, the Supreme Court's majority and dissenting opinions, and the likely impact of the case, see Arnold W. Reitze, Jr., *Controlling Greenhouse Gas Emissions From Mobile Sources—Massachusetts v. EPA*, 37 *Env't. L. Rep. News & Analysis* (Env't. L. Inst.) 10535 (2007); see also Michael Sugar, Note, *Massachusetts v. Environmental Protection Agency*, 31 *HARV. ENVTL. L. REV.* 531 (2007).

²⁵ The majority opinion begins with the observation that "[a] well-documented rise in global temperatures has coincided with a significant increase in the concentration of carbon dioxide in the atmosphere. Respected scientists believe the two trends are related." 127 S. Ct. at 1446. This basic factual assertion is accepted and extended throughout the opinion, leading one observer to suggest that "the broader cultural or symbolic significance of the decision [is that the] Court has accepted—indeed has seemed to internalize—the beliefs, assumptions, and values that animate environmentalists' views on climate change." Jonathan Z. Cannon, *The Significance of Massachusetts v. EPA*, 93 *VA. L. REV. IN BRIEF* 51 (2007). Indeed, the case is regarded as "a breathtaking result for environmentalists. The first time that environmentalists have both persuaded the Supreme Court to grant review over the federal government's opposition and then won on the merits." Richard Lazarus, *A Breathtaking Result for Greens*, *THE ENVTL. FORUM*, May-June 2007, at 12, 12.

²⁶ 127 S. Ct. at 1459-60. The Clean Air Act defines "air pollutant" in sweeping terms to include "any air pollutant agent...including any physical, chemical [or] biological...substance or matter which is emitted into or otherwise enters the ambient air." 42 U.S.C. § 7602(g). The Court found that "greenhouse gasses fit well within [this] capacious definition." 127 S. Ct. at 1462.

²⁷ 127 S. Ct. at 1462.

²⁸ 42 U.S.C. 7521(a)(1).

²⁹ 127 S. Ct. at 1462-63.

do not contribute to climate change or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do. To the extent that this constrains agency discretion to pursue other priorities of the Administrator or the President, this is the congressional design.³⁰

So too, pika lovers might argue, must the ESA be construed to require the FWS to integrate the changing circumstances and scientific developments surrounding climate change into administration of the statute. Indeed, after *Massachusetts v. EPA*, one can argue it is incumbent on *all* federal regulatory agencies to assess how global climate change is to be integrated into their respective regulatory programs. There is no dodging the bullet—each agency must place the current knowledge of climate change and its reasonably anticipated trajectory next to its regulatory statute and ask, how do they fit together?

Yet in setting this inquiry in motion, the Court raised far more questions than it answered. It is one thing to say an agency must consider whether climate change triggers regulatory authorities under a particular statute, and quite another thing to decide, if so, what the statute requires. Just as agencies are not immune from having to incorporate global climate change as regulatory subject matter, climate change as regulatory subject matter is not immune from agency discretion. Some statutes—perhaps the Clean Air Act is an example—will force the agency down a narrow road toward regulation of greenhouse gas emissions, but other statutes will leave ample room for an agency to argue, depending on its agenda, that greenhouse gas emissions and climate change are or are not appropriate subjects for regulation. Evaluating the fit between a regulatory program and climate change thus will often boil down to identifying the scope of discretion an agency has at its disposal with respect to climate change and determining how the agency can legitimately exercise it. The EPA knows now that it must make a decision about the effects of greenhouse gas emissions from motor vehicles and whether to regulate them, but what is the scope of the agency’s discretion in making that decision? That is the question the Court in *Massachusetts v. EPA* left for the EPA to answer under the Clean Air Act.³¹

This Article explores that question for the ESA in its present form.³² Part II of the Article describes the effects of climate change and different ways in which it is likely to exacerbate species endangerment both in terms of number of species at risk and severity of their imperilment. As noted ecologist Jane Lubchenco has put it, “we’ve entered new territory.”³³

³⁰ 127 S. Ct. at 1462. As its only example of a “reasonable explanation,” the Court suggested that EPA might find “the scientific uncertainty is so profound that it precludes EPA from making a reasoned judgment as to whether greenhouse gases contribute to global warming.” 127 S. Ct. at 1463. Yet having previously observed that “respected scientists” believe greenhouse gases do contribute to climate change, *see* 127 S. Ct. at 1446, the Court seems to have left EPA little wiggle room. *See* Reitze, *supra* note __, at 10538 (“the Court’s opinion pushes EPA to find that GHGs need to be regulated”); Cannon, *supra* note __, at 57 (“the Court’s opinion seems to leave EPA little room in dealing with climate change”).

³¹ *See* 127 S. Ct. at 1463 (“We need not and do not reach the question whether on remand EPA must make an endangerment finding, or whether policy concerns can inform EPA’s actions in the event that it makes such a finding.”)

³² This Article addresses the scope of agency discretion under existing statutory provisions. Although the Article examines potential rulemaking reforms within the scope of existing statutory authority, I neither suggest nor review proposed statutory reforms of the ESA or any other statute to respond to climate change.

³³ As quoted at Science Daily, *Fish, Marine Biology, Oceanography, Global Warming, Nature, Climate Interplay Of Climate And Currents Disrupts Marine Ecosystems* (Feb. 28, 2007), available at <http://www.sciencedaily.com/releases/2007/02/070218140507.htm> (last visited July 19, 2007).

Complex direct and indirect mechanisms are likely to be in play, usually in ways less obvious than the stranding of the pika or the melting away of the polar bear's ice. Many ecologists believe we face a no-analog future—one for which we have no experience on which to base projections of ecosystem change³⁴ and for which models designed to allow active management decisions as climate change takes effect are at present rudimentary and imprecise.³⁵ It is not as if ecosystems will move intact as climate conditions shift; rather, they will disassemble as climate change rips apart existing hydrological, temperature, fire, flood, drought, wind, and pest regimes at local levels, with new assemblies forming in their place. And as humans adapt to climate change by moving away from coastal areas and shifting the locations of agricultural land uses, it is likely that we will disturb ecological systems with potentially dramatic effects on resident species. A taxonomy of climate change effects on species thus is useful for understanding the challenges the FWS will face in administering the ESA as the realities of climate change begin to take hold in ecosystems.³⁶

Yet the FWS, like most administrative agencies, has been implementing the ESA's regulatory programs for decades, so what is new about climate change? What is the challenge other than there being more species at risk and many of them in more dire straits? Is it just a matter of degree, or is climate change a different kind of problem altogether for agency discretion? Part III of the Article engages these questions by exploring the types of challenges climate change will pose for the ESA. As many agencies must, FWS often exercises its discretion by balancing between the statute's primary purpose (protecting species), other mediating statutory criteria (e.g., economic impacts), and background social, legal, and economic contexts not registered directly in the statute but placing pressure on its implementation (e.g., property rights).³⁷ Global climate change does not fit into one of those boxes; rather, it engulfs all of them and shakes the regulatory system at its roots. The range of possible (but not necessarily permissible) policy responses an agency might devise in such a dynamic and uncertain context is thus quite broad, from doing absolutely nothing about it to incorporating global climate change to the maximum in every nook and cranny of the regulatory program. The FWS will face these choices with respect to actions that emit greenhouse gases, actions that harm

³⁴ See Douglas Fox, *Back to the No-Analog Future?*, 316 SCIENCE 823, 823 (2007); Douglas Fox, *When Worlds Collide*, CONSERVATION, Jan.-Mar. 2007, at 28.

³⁵ See Peter Cox and David Stephenson, *A Changing Climate for Prediction*, 317 SCIENCE 207 (2007). For more on these modeling difficulties, see Part II.A *infra*.

³⁶ It also provides an example of what regulatory programs dealing with *human* social and economic institutions can expect in a climate change future. Like ecosystems, one can foresee human communities and economies responding in “reshuffling” patterns that defy extrapolation from historical trends and for which models are at present theoretical at best. If, for example, climate change shifts agriculturally productive conditions northward from, say, Kansas, how likely is it that agricultural communities in Kansas will simply pick up and relocate northward fully intact? Consider, for example, the diaspora of New Orleanians that followed Hurricane Katrina. Of over 1.3 million applicants for federal assistance, 86 percent came from people who had relocated to Louisiana, Mississippi, Texas, and Alabama, but applications came from every state and from more than 35,000 families that had moved over 1000 miles from the Gulf. Over half of the applications were filed by people that had relocated over 100 miles from New Orleans. See New York Times, *Katrina's Diaspora*, http://www.nytimes.com/imagepages/2005/10/02/national/nationalspecial/20051002diaspora_graphic.html (last visited June 10, 2007).

³⁷ The examples given define the history of ESA implementation. See J. Michael Scott et al., *Introduction*, in THE ENDANGERED SPECIES ACT AT THIRTY, *supra* note ___, at 3.

species endangered because of climate change, and actions that are aimed at conserving species but which may be impeded by climate change.

Of course, the choices are not all for the FWS to make. Part IV of the Article methodically evaluates the permissible discretion space Congress has defined for the agency's selection of climate change policies. Like many regulatory statutes, the ESA is a conglomerate of different regulatory tasks and programs, each with its own idiosyncratic discretionary context, and thus each presents a different fit with global climate change. The challenge for the FWS is that each species presents its own set of circumstances with respect to the effects of climate change, meaning the agency has potentially thousands of different scenarios to track through its statutory discretion analysis. Overall, the analysis shows that the agency has considerable flexibility in terms of how it uses (or doesn't use) global climate change as a driver of regulatory policy, though some choke points limit the agency's discretion and, if *Massachusetts v. EPA* is any indication, will force the FWS to confront difficult policy decisions.

Given that regulatory landscape, Part V addresses the practical question of what the FWS should do in the absence of congressional action either with respect to the ESA specifically or in more general ways that relieve pressure from the ESA. I propose a coherent game plan for the agency based on four assumptions: (1) even with swift and effective adoption of global-wide greenhouse gas emission mitigation measures, some residual climate change will continue to occur over the next 50 years; (2) realistically, global-wide mitigation measures will not entirely reverse greenhouse gas emissions to 1990 levels; but (3) mitigation measures will stabilize emissions at a level which will allow global climate regimes eventually to settle into a "natural" pattern of variation; and (4) some species will not survive the transition from the present to that future no matter what actions the FWS takes under the ESA, but others can make it if we help them through the transition. Under these assumptions, I argue that the FWS should *not* attempt to use the ESA to combat greenhouse gas emissions or save all species threatened by climate change, but rather should use it as the bridge to the no-analog future for those species that can benefit from the ESA's helping hand. Part V closes by elaborating in more detail the policy choices the agency should make to implement this use of the ESA, including how to respond to the effects human adaptation to climate change has on species.³⁸

Like most other existing regulatory statutes, the ESA was not enacted with global climate change in mind, and the ESA alone will not arrest the causes or effects of our planet's no-analog future. But for the foreseeable future, until Congress or the states adopt statutes responding directly and comprehensively to climate change, the ESA is the nation's principal species conservation program. Even if the ESA cannot reverse climate change, pressure will be brought to bear on the FWS, just as it was on the EPA, to use its regulatory powers to "whittle away" at the problem.³⁹ After *Massachusetts v. EPA* the agency will have little choice but to do so, the question being where and how deeply it must cut.

³⁸ Until recently, legal scholarship on climate change has focused primarily on mitigation efforts—i.e., legal measures aimed at reducing greenhouse gas emissions. Given the reality that climate change will continue for some time even if stiff measures are taken globally to reduce greenhouse gas emissions over the next 25-50 years, attention is turning to the law of climate change adaptation—i.e., regulation and facilitation of human responses to climate change. For a sweeping overview of many of the environmental law issues relating to climate change adaptation (though not including the ESA issues in detail), see Matthew D. Zinn, *Adapting to Climate Change: Environmental Law in a Warmer World*, 34 *ECOLOGY L.Q.* 61 (2007).

³⁹ As the majority in *Massachusetts v. EPA* observed, "agencies, like legislatures, do not generally resolve massive problems in one fell swoop, but instead whittle away over time, refining their approach as circumstances

II. CLIMATE CHANGE AS AN AGENT OF ECOLOGICAL RESHUFFLING

The ESA is a change management law designed to arrest change in one direction—the decline of a species—and turn to corner to a new trajectory of change—recovery of the species. FWS administers several core programs aimed toward that objective, the details of which are more fully explored later in the Article:

- Section 4 authorizes FWS to identify “endangered” and “threatened” species, known as the listing function,⁴⁰ and then to designate “critical habitat”⁴¹ and develop “recovery plans”⁴² for the species.
- Section 7 requires all federal agencies to “consult” with FWS to ensure that actions they carry out, fund, or authorize do not “jeopardize” the continued existence of listed species or “adversely modify” their critical habitat.⁴³
- Section 9 requires that all persons, including all private and public entities subject to federal jurisdiction, avoid committing “take” of listed species of fish and wildlife.⁴⁴
- Sections 7 (for federal agency actions) and 10 (for actions not subject to Section 7) establish a procedure and criteria for FWS to approve “incidental take” of listed species.⁴⁵

change and they develop a more nuanced understanding of how best to proceed. 127 S. Ct. at 1442 (citations omitted).

⁴⁰ 16 U.S.C. § 1533(a)(1) (2000). For a description of the listing process, see STANFORD ENVIRONMENTAL LAW SOCIETY, *supra* note __, at 38–58; LIEBESMAN & PETERSEN, *supra* note __, at 15–20; SULLINS, *supra* note __, at 11–25; J.B. Ruhl, *Section 4 of the ESA: The Keystone of Species Protection Law*, in LAW, POLICY, AND PERSPECTIVES, *supra* note __, at 19. *See also infra* notes __-__ and accompanying text.

⁴¹ 16 U.S.C. § 1533(a)(3) (2000). For a description of the critical habitat designation process, see STANFORD ENVIRONMENTAL LAW SOCIETY, *supra* note __, at 59–69; LIEBESMAN & PETERSEN, *supra* note __, at 20–24; SULLINS, *supra* note __, at 26–28; Federico Cheever, *Endangered Species Act: Critical Habitat*, in LAW, POLICY, AND PERSPECTIVES, *supra* note __, at 47; Murray D. Feldman & Michael J. Brennan, *The Growing Importance of Critical Habitat for Species Conservation*, 16 NAT. RESOURCES & ENV'T 88 (2001). *See also infra* notes __-__ and accompanying text.

⁴² 16 U.S.C. § 1533(f) (2000). For a description of the recovery plan process, see STANFORD ENVIRONMENTAL LAW SOCIETY, *supra* note __, at 71–77; LIEBESMAN & PETERSEN, *supra* note __, at 24–26; SULLINS, *supra* note __, at 34–38; John M. Volkman, *Recovery Planning*, in LAW, POLICY, AND PERSPECTIVES, *supra* note __, at 71. *See also infra* notes __-__ and accompanying text.

⁴³ 16 U.S.C. § 1536(a)(2) (2000). For a description of the consultation process, see STANFORD ENVIRONMENTAL LAW SOCIETY, *supra* note __, at 83–103; LIEBESMAN & PETERSEN, *supra* note __, at 27–39; SULLINS, *supra* note __, at 59–86; Marilyn Averill, *Protecting Species Through Interagency Cooperation*, in LAW, POLICY, AND PERSPECTIVES, *supra* note __, at 87. *See also infra* notes __-__ and accompanying text.

⁴⁴ 16 U.S.C. § 1538(a)(1) (2000). For a description of the cases developing the legal standards for what constitutes “take,” see STANFORD ENVIRONMENTAL LAW SOCIETY, *supra* note __, at 104–12; LIEBESMAN & PETERSEN, *supra* note __, at 39–45; SULLINS, *supra* note __, at 44–53; Gina Guy, *Take Prohibitions and Section 9*, in LAW, POLICY, AND PERSPECTIVES, *supra* note __, 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 __, at 207; Alan M. Glen & Craig M. Douglas, *Taking Species: Difficult Questions of Proximity and Degree*, 16 NAT. RESOURCES & ENV'T 65 (2001). *See also infra* notes __-__ and accompanying text.

⁴⁵ 16 U.S.C. §§ 1536(b)(4) (federal agency actions) and 1539(a)(1) (other actions) (2000). “Incidental take,” although not the subject of a specific statutory definition provision, is described in section 10 of the statute as take that is “incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.” *Id.* § 1539(a)(1)(B). FWS has adopted this meaning for purposes of the regulations implementing section 7 incidental take authorization.

The regulatory firepower these programs generate comes in the form of authority to intervene in several categories of change in environmental conditions that cause species decline: (1) the present or threatened destruction, modification, or curtailment of habitat; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; and (4) other natural or manmade factors.⁴⁶ Of course, this authority is only effective in circumstances where intervention is feasible and to the extent it is effective. For example, habitat loss, the leading cause of species decline,⁴⁷ is often the result of easily identifiable human-induced factors susceptible to discrete and effective regulation.⁴⁸ By contrast, invasive species, the runner-up in causes of species decline,⁴⁹ present in almost all cases exceedingly complex causes and solutions,⁵⁰ meaning there usually is no identifiable regulatory target.⁵¹

In this respect climate change presents a complicated scenario. To be sure, there is an easily identifiable regulatory target—greenhouse gas emissions. Leaving until later the question of how much discretion the ESA affords the FWS to regulate greenhouse gas emissions, there are obvious practical obstacles to this approach. First, regulating emissions in the United States alone is highly unlikely to be sufficient to reduce global emission levels.⁵² Second, even if regulatory measures are implemented worldwide to curtail emissions, the political reality is that they will impose phased-in reductions taking several decades to return to benchmark emission levels designed to stabilize or reduce greenhouse gas concentrations in the troposphere.⁵³ Most

50 C.F.R. § 402.02 (2003). For a description of the incidental take authorization procedures, see SELS, *supra* note __, at 127–73; LIEBESMAN & PETERSEN, *supra* note __, at 46–50; SULLINS, *supra* note __, at 87–102. *See also infra* notes __-__ and accompanying text.

⁴⁶ These are the factors upon which listing decisions are made. *See* 16 U.S.C. §§ 1533(a)(1)(A)-(E).

⁴⁷ *See* David Wilcove et al., *Quantifying Threats to Imperiled Species in the United States*, 48 *BIOSCIENCE* 607 (1998).

⁴⁸ Indeed, this is the source of the statute’s “pit bull” status and largely the reason it is so controversial—discrete actions directly impairing habitat of protected species make for easy targets of ESA regulation. *See* Glen & Douglas, *supra* note __.

⁴⁹ *See* David Wilcove et al., *Quantifying Threats to Imperiled Species in the United States*, 48 *BIOSCIENCE* 607 (1998).

⁵⁰ *See* Peter M. Vitousek et al., *Biological Invasions as Global Environmental Change*, 84 *AM. SCIENTIST* 468 (1996). For a series of articles covering the invasive species issue comprehensively, *see Special Section: Population Biology of Invasive Species*, 17 *CONSERVATION BIOLOGY* 24 (2003).

⁵¹ One exception is ship ballast water discharges, which have been a remarkably effective means of transporting aquatic species around the globe and have thus become a subject of intense regulatory focus. *See* Sandra B. Zellmer, *The Virtues of “Command and Control” Regulation: Barring Exotic Species from Aquatic Ecosystems*, 2000 *U. ILL. L. REV.* 1233. The United States Coast Guard adopted regulations covering ballast water discharges in 2004. *See* 69 *Fed. Reg.* 32869 (June 14, 2004) (codified at 33 C.F.R. pt. 151).

⁵² The FWS cannot regulate developing nations such as China, which has become the world’s leading source of greenhouse gas emissions and has shown only tentative interest in self-imposed or internationally-imposed emission limits. *See* Kathleen E. McLaughlin, *Report Says Country Has Already Overtaken U.S. as Leading Source of Carbon Emissions*, 38 *Env’t Rep.* (BNA) 1429 (2007); Hou Yanli and Hu Min, *China and Her Coal*, *WORLDWATCH*, Jan.-Feb. 2007, at 14; Daniel Pruzin, *China “Will not Accept” Emissions Limits; Government Advisor Cites Insufficient Data*, *Daily Env’t* (BNA), July 9, 2007, at A-2.

⁵³ For example, following California’s lead, in 2007 Florida Governor Charlie Crist signed executive orders directing the adoption of maximum emission levels of greenhouse gases for electric utilities. The standard will require a reduction of emissions to 2000 levels by 2017, to 1990 levels by 2025, and to 80 percent of 1990 levels by 2050. Florida will also adopt the California motor vehicle emission standards, pending EPA approval of a waiver from federal standards, imposing a 22-percent reduction in vehicle emissions by 2012 and a 30-percent reduction by

significantly, however, even if benchmark levels are attained in the near future, the physical dynamics of greenhouse gas effects on climate are such that climate change will continue on its present trajectory for a significant time period.⁵⁴

Even if the ESA were enlisted as a regulatory weapon against greenhouse gas emissions, therefore, the imminent challenge for the statute will be how effective it is in addressing the unavoidable impacts of climate change that have been set in motion by past emissions and which will play out domestically over at least the next 50 years. In this sense climate change presents scenarios that make anything FWS has faced in the past look simple. A complex array of climate change effects will lead directly to primary and secondary stresses on ecosystems which we have never before seen or even contemplated, not to mention a tertiary wave of stresses caused when humans themselves adapt to climate change. The picture, to say the least, is not pretty.

A. Feedback, Nonlinearity, and Reshuffling—Facing a No-Analog Future

Three metrics drive much of the discussion of climate change as a *global* phenomenon: rising tropospheric carbon dioxide levels as a causal agent, and rising mean global surface temperatures and sea levels as the global effects.⁵⁵ The cause and effect relationships at this level are fairly well understood: carbon dioxide and other greenhouse gases trap heat radiating from the earth's surface, which causes surface level temperatures to rise, which in turn causes polar and glacial ice to melt and ocean water volume to expand, which cause sea levels to rise.⁵⁶ Nevertheless, models of surface temperature and sea level changes assembled not too long ago are already proving inaccurate based on observed conditions. In general, although generally accepted projections of carbon dioxide levels in the atmosphere appear to closely track observed conditions, global mean surface temperature is rising at a rate in the far upper range of model predictions and sea level is rising faster than the upper range of model predictions,⁵⁷ and more

2016. See State of Florida, Office of the Governor, Exec. Order 07-127 (July 13, 2007), available at <http://www.myfloridaclimate.com/news/article/34>. For summaries of other proposed and adopted federal and state benchmarks, see Stephen C. Jones and Paul R. McIntyre, *Filling the Vacuum: State and Regional Climate Change Initiatives*, 38 *Envtl. Rep. (BNA)* 1640 (2007); Pew Center on Global Climate Change, *A Look at Emissions Targets*, http://www.pewclimate.org/what_s_being_done/targets (last visited Aug. 23, 2007). Many observers believe these benchmarks are unrealistic. See, e.g., Robert N. Stavins, *Free GHG Cuts: Too Good to be True?*, *THE ENVTL. FORUM*, May-June 2007, at 16 (asserting that the cost estimates California and Florida are providing for these benchmark goals are wildly low).

⁵⁴ See IPCC, *CLIMATE CHANGE IMPACTS SUMMARY*, *supra* note __, at 18 (“past emissions are estimated to involve some unavoidable warming...even if atmospheric greenhouse gas concentrations remain at 2000 levels”). Of course, if one believes that climate change is purely natural in cause, then presumably it will continue for some period—perhaps a very long period—regardless of emission reductions.

⁵⁵ See Stefan Rahmstorf et al., *Recent Climate Observations Compared to Projections*, 316 *SCIENCE* 709 (2007).

⁵⁶ This causal chain as well as other primary and secondary drivers, both natural and anthropogenic, are covered in IPCC, *PHYSICAL SCIENCE BASIS SUMMARY*, *supra* note __. Although much attention has been focused on ice sheet calving and melting, melting of glacial ice appears to be contributing about 60 percent of the “new water” component of sea level rise. See Mark F. Meier et al., *Glaciers Dominate Eustatic Sea-Level Rise in the 21st Century*, 317 *SCIENCE* 1064 (2007).

⁵⁷ See Stefan Rahmstorf et al., *Recent Climate Observations Compared to Projections*, 316 *SCIENCE* 709 (2007). Given the complexity of the problem, it is no surprise that climate change effects models are proving difficult to calibrate. Even when climate change has not been a factor, reliable models using weather forecast variables to predict the secondary effects of annual weather patterns on other phenomenon have proven elusive. One

recently developed models suggest the trends will soon drift considerably above those ranges.⁵⁸ In other words, even what we understand best about climate change has proven difficult to model and predict.

Climate change, it turns out, is not a one-variable, one-way phenomenon. Greenhouse gases are not the only atmospheric condition affecting surface temperature. Dust, pollutant haze, and other aerosols in the atmosphere, for example, deflect incoming solar radiation and thus have a cooling effect.⁵⁹ As temperatures rise, moreover, other positive and negative feedback effects are triggered that could amplify or impede further warming. Melting tundra, for example, releases more greenhouse gases, and researchers have found this effect, because of feedback properties, is far exceeding expected levels.⁶⁰ On the other hand, increased duration and intensity of fire regimes may increase warming effects in the short-term because of carbon dioxide emissions, but reduce temperatures in the long-term because of increased surface reflectivity (albedo).⁶¹ As climate change is increasingly studied, nonlinear feedback loops like these are being uncovered,⁶² making it excruciating difficult to construct models of global trends over long time periods.

Of course, what matters for most regulatory agencies is not how well we predict mean global trends such as surface temperature and sea levels, but what happens at the sub-global regional and local levels at which agencies must make active management decisions in response to climate change effects. In other words, as surface temperatures and sea levels rise, agencies need to know what happens next, and where. As the Environmental Protection Agency puts it, “effects of global change drivers differ by place and in scale, necessitating place-specific impacts information to enable stakeholders to respond appropriately.”⁶³ Yet even rather fundamental secondary effects questions, such as where it will rain more and less and how fast the ice will melt, remain open to wide variation in available models.⁶⁴ For example, in its proposal to list the

recent study showed, for example, that river-level forecasting using annual weather forecast variables is at best moderately accurate only three days into the future. See Richard A. Kerr, *River-Level Forecasting Shows No Detectable Progress in 2 Decades*, 316 *SCIENCE* 1555 (2007).

⁵⁸ See Doug Smith et al., *Improved Surface Temperature Prediction for the Coming Decade from a Global Climate Model*, 317 *SCIENCE* 796 (2007) (concluding that natural cooling trends that have been offsetting human-induced warming will die out by 2009, giving way to untempered human-induced warming); Richard Kerr, *Humans and Nature Duel Over the Next Decade’s Climate*, 317 *SCIENCE* 746 (2007) (explaining the difficulty, but necessity, of building climate change models that take into account human-induced and natural climate variation causes).

⁵⁹ See *Another Global Warming Icon Comes Under Attack*, 317 *SCIENCE* 28 (2007) (explaining that because “aerosols cool the planet by reflecting away sunlight and increasing the reflectivity of the clouds,” climate change models can vary widely depending on assumptions about aerosol levels)

⁶⁰ See Katey M. Walter et al., *Methane Bubbling from Siberian Thaw Lakes as a Positive Feedback to Climate Warming*, 443 *NATURE* 71 (2006). The effect leads to a positive feedback loop: as the greenhouse gases are released, they contribute to warming that melts the tundra faster, which releases more greenhouse gases more rapidly, and so on. See Katey M. Walter et al., *Methane Bubbling from Northern Lakes: Present and Future Contributions to the Global Methane Budget*, 365 *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A* 1657 (2007).

⁶¹ See J.T. Randerson et al., *The Impact of Boreal Forest Fire on Climate Warming*, 314 *SCIENCE* 1130 (2006).

⁶² These and others are discussed in IPCC, *PHYSICAL SCIENCE BASIS SUMMARY*, *supra* note ____.

⁶³ U.S. Environmental Protection Agency, *Climate and Land Use Change Effects on Ecological Resources in Three Watersheds: A Synthesis Report*, 72 Fed. Reg. 45045 (Aug. 10, 2007) (notice of availability of local effects study).

⁶⁴ See Frank J. Wentz et al., *How Much More Rain Will Global Warming Bring?*, 317 *SCIENCE* 233 (2007). The difficulties associated with downscaling global climate change to local secondary effects are relevant, of course, not only to legal responses to threats posed to species, but to threats posed to human populations as well. See Robert L.

polar bear as a threatened species under the ESA, the FWS pointed out “studies indicate that previous projections regarding the rate and extent of climate change underestimated the temperature trend, reductions to annual sea ice during the summer and winter periods, reductions to multi-year pack ice, and reductions in thickness.”⁶⁵

Indeed, for the FWS it often will be the case that what matters for a particular species is primarily a function of local ecological conditions and their effects on the species. FWS, in other words, has to find models that predict the effects of global climate warming on a wide range of physical and biological cycles, “downscale” those effects to local ecological conditions, and then evaluate the effects of those local changes on the species of concern. The problem with such specific downscaling efforts is that the nonlinear feedback properties making climate change effects difficult to model and predict at mean global levels will operate with even more volatility at regional and local levels, making accurate models supporting active management decisions all the more difficult to design.⁶⁶ As the U.S. Climate Change Science Program has summarized:

In spite of the great interest and importance in understanding and forecasting ecosystem responses to climate change and variability, it is often difficult to relate specific, observable responses in ecosystems to climate change in a rigorous, causal manner. This is partly because climate variables are linked to specific ecosystem responses through complex, nonlinear chains of interacting processes. Part of the difficulty is also related to the need to “downscale” attributes of change in a climate system to understand ecosystem changes at regional or ecoregional scales. Moreover, effects of climate change on ecosystems and their constituent species and processes are typically confounded with effects of numerous other human actions, including land-use changes that fragment and degrade ecosystems at various spatial scales, pollutants, invasions of non-native species, and resource management and utilization practices. It is difficult to tease apart effects of climate change from these other effects. These challenges are made more difficult by the current paucity of long-term data

Glicksman, *Global Climate Change and the Risks to Coastal Areas from Hurricanes and Rising Sea Levels: The Costs of Doing Nothing*, 52 LOY. L. REV. 1127 (2006).

⁶⁵ 72 Fed. Reg. 1064, 1071 (Jan 9, 2007). Indeed, the degree to which projections were off appears to be considerable—we are approximately 30 years ahead of what the mean of the ensembled models forecasted losses would have been by 2006. See Julienne Stroeve et al., *Arctic Sea Ice Decline: Faster than Forecast*, 34 GEOPHYSICAL RESEARCH LETTERS L09501, 5 (2007). In an effort to bring the models up to date with observations so as to assist the FWS in its polar bear assessment, in 2007 the U.S. Geological Survey screened all models that failed to predict within 20 percent of the 2006 September sea ice extent of the Arctic and projected future trends based on the remaining models. See Eric DeWeaver, *Uncertainty in Climate Model Projections of Arctic Sea Ice Decline: An Evaluation Relevant to Polar Bears* (2007). Using only the models that satisfied this accuracy test—there were only ten—the agency found that “all lose at least 30 % of their September ice extent, and 4 lose over 80 % of their September ice by the middle of the 21st Century.” *Id.* at 1. Seven of the ten models proven to be most accurate thus far are ice free by September 2099. *Id.* Applying these projections to the known ecoregions of polar bear habitat, the agency concluded that two-thirds of the world’s polar bear population will be lost by 2050. See U.S. Geological Survey, *USGS Science to Inform U.S. Fish & Wildlife Service Decision Making on Polar Bears, Executive Summary 2* (2007). The full set of USGS reports is available at the agency’s *Polar Bear Finding Webpage*, <http://www.usgs.gov/newsroom/special/polar%5Fbears/> (last visited September 12, 2007).

⁶⁶ See U.S. Climate Change Science Program, *Public Review Draft, CCSP Synthesis and Assessment Report 3.1, Climate Models: An Assessment of Strengths and Limitations for User Applications 8* (May 15, 2007) (describing problems with existing capacities for downscaling).

and information for most ecosystem types and ecoregions, especially from experiments designed to ascertain cause-and-effect relationships.⁶⁷

Fundamentally, therefore, the FWS has no models of this sort at its disposal because nobody has the experience or knowledge upon which to base them. Ultimately, moreover, they may simply be beyond our capacity. Although all ecosystems undergo disturbance regimes such as flood, fire, and drought, ecologists understand that these forms of disturbance are part of the stable disequilibrium of resilient, dynamic ecosystems.⁶⁸ But climate change presents not just another such disturbance regime the operations of which we can extrapolate from current ecological knowledge; rather, it will be the undoing of ecosystems as we know them.⁶⁹ As leading ecologists have predicted,

new climates are expected to cause ecosystem reshuffling as individual species, constrained by different environmental factors, respond differently. One tree may be limited by summer rains that hold back seedling recruitment, for instance, whereas another species may be limited by winter freezes that control insect pests. Some species may migrate up-latitude or up-elevation, while others may stay put. An ecosystem may see many species vanish—but also new arrivals.⁷⁰

These scenarios are no longer hypothetical. For example, oceanographers, climatologists, and ecologists at the 2007 American Association for the Advancement of Science meeting reported that unusual ocean conditions and marine die-offs are changing the way scientists think about the future of ocean resources off the Pacific coast of the United States.⁷¹ The researchers synthesized decades of atmospheric and oceanographic data, revealing that increasingly wild fluctuations in winds and currents appear to account for a series of recent anomalous ocean events—from repeated low oxygen zones larger than the size of Rhode Island to massive die offs of seabirds. They found the underlying swings in winds and position of the jet stream consistent with climate change predictions, but as one of the researchers observed, “climate change is upon us, there is no doubt about that ... What's catching us by surprise is the rate at which warming is hitting us. And, of course, how fast the ocean has changed—that is what amazes me.”⁷²

⁶⁷ U.S. Climate Change Science Program, CCSP Synthesis and Assessment Product 4.2, Prospectus for Thresholds of Change in Ecosystems 1 (June 30, 2006) (describing the scope of research to be conducted on ecological downscaling models). It is, of course, equally as important to study and understand macroecological effects. See Jeremy T. Kerr et al., *The Macroecological Contribution to Global Change Solutions*, 316 SCIENCE 1581 (2007).

⁶⁸ For a comprehensive treatment of disequilibrium and resilience theories of ecosystem dynamics, see PANARCHY: UNDERSTANDING TRANSFORMATION IN HUMAN AND NATURAL SYSTEMS (Lance H. Gunderson and C.S. Holling eds., 2002).

⁶⁹ See IPCC, CLIMATE CHANGE IMPACTS SUMMARY, *supra* note __, at 8 (“The resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land use change, pollution, over-exploitation of resources).”)

⁷⁰ Douglas Fox, *Back to the No-Analog Future?*, 316 SCIENCE 823, 823 (2007).

⁷¹ Science Daily, *Interplay Of Climate And Currents Disrupts Marine Ecosystems* (Feb. 28, 2007), available at <http://www.sciencedaily.com/releases/2007/02/070218140507.htm> (last visited July 19, 2007).

⁷² *Id.* (quoting Bill Peterson of NOAA). The U.S Climate Change Science Program is as of this writing working to complete a comprehensive overview of ecological responses and adaptations to climate change, known as Synthesis and Assessment Product 4.4: Preliminary Review of Adaptation Options for Climate-Sensitive

This is the no-analog future of the ESA. Some effects will be predictable, such as that warmer waters will exceed the temperature limits of some fish species.⁷³ Other effects will be difficult to predict, such as the cascade effects the loss of a top-level predator fish causes in its ecosystem.⁷⁴ Where and when these effects will occur, their magnitude and duration, and the other effects they will set in motion for species are questions the FWS has only begun to confront for the ESA.

B. A Typology of Climate Change Threats to Species

Although accurate prediction of climate change effects on local ecological conditions is for now (and perhaps always will be) beyond the capacity of ecological models, a taxonomy of effects can be constructed and may be useful for purposes of evaluating where the ESA most effectively can be employed when effects of climate change threaten the continued existence of a species. I divide the taxonomy at its highest level between primary ecological effects, secondary ecological effects, and human adaptation impacts.⁷⁵

1. Primary Ecological Effects

The pika presents a relatively straightforward scenario of climate-induced species decline—the ecological conditions it needs for survival do not exist below a particular temperature regime. Of course, it is possible that as climate change takes hold suitable conditions for the pika will materialize somewhere else in the world, but that will do the pikas of the Great Basin little good. They do not have the option of flying once the temperature regime lifts above the peaks on which they now survive.⁷⁶ Rather, the pika and other species with specific ecological needs and limited migration capacity are likely to face significant threats from this kind of first order change in ecological conditions. Threats in this category will come in several forms.

Stranding. Some species will not be able to withstand the degradation or complete loss of essential habitat conditions beyond tolerable thresholds and will have no adaptive capacity to migrate to seek suitable conditions elsewhere.⁷⁷

Life-Stage Habitat Loss. Some species will find ecological conditions for essential life-stage junctures, such as migratory pathways or refuge habitat during juvenile stages, disrupted beyond tolerable thresholds, making the continued availability of suitable ecological conditions for other life-stages irrelevant.⁷⁸

Ecosystems and Resources. See 72 Fed. Reg. 46610 (Aug. 21, 2007) (notice of availability of draft report for public comments).

⁷³ See Hans O. Portner and Rainer Knust, *Climate Change Affects Marine Fishes Through the Oxygen Limitation of Thermal Tolerance*, 315 SCIENCE 95 (2007).

⁷⁴ See Ransom A. Myers et al., *Cascading Effects of the Loss of Apex Predatory Sharks from a Coastal Ocean*, 315 SCIENCE 1846 (2007).

⁷⁵ All of the impact categories covered in my typology have been discussed to one extent or another in scientific literature. See, e.g., IPCC, CLIMATE CHANGE AND BIODIVERSITY, *supra* note __. My arrangement of them is designed to connect with the legal analysis of the ESA covered *infra* in Parts III-V.

⁷⁶ Of course, humans have the option of flying pikas to new locations. I take up the issue of “assisted migration” *infra*.

⁷⁷ See IPCC, CLIMATE CHANGE AND BIODIVERSITY, *supra* note __, at 22.

⁷⁸ See IPCC, CLIMATE CHANGE AND BIODIVERSITY, *supra* note __, at 17-18.

Altered Biological Events. Some species will respond to climate change, particularly warming of surface and water temperatures, through phenologic changes such as shifts in the timing of budding, spawning, or migration. If, as is likely, all ecologically linked species do not shift in synch, some species may face significant threats.⁷⁹

2. Secondary Ecological Effects

Not all species will find it necessary and possible to depart their current ecosystems in order to withstand the direct effects of climate change, but many will. Others will stay to fight it out. While humans might cheer these species on, the aggregate effects of ecological disruption and species reshuffling are likely to lead to several secondary threats.

Increased Stress. Some species will not experience primary ecological changes beyond tolerable thresholds, but will experience increased stress as those thresholds are approached and will become more susceptible to disease, parasitism, predation, and other forms of mortality.⁸⁰

Successful Adaptive Migration. As some species adapt to climate change by successfully migrating to and establishing in areas that, because of climate change, then present suitable conditions, their introduction may disrupt predator-prey or other ecological conditions to the detriment of other species.⁸¹ One species' successful adaptive migration, in other words, can be another's demise.⁸²

Opportunistic Invasion. In the opposite of increased stress effects, some species will find an erosion of barriers, such as temperature limits or water availability, which formerly prevented them from successfully establishing in a particular area notwithstanding a history of natural or human-induced introduction opportunities. Climate change will close down on some species, but open doors for others.⁸³

⁷⁹ See IPCC, CLIMATE CHANGE AND BIODIVERSITY, *supra* note __, at 12.

⁸⁰ See IPCC, CLIMATE CHANGE AND BIODIVERSITY, *supra* note __, at 13-14.

⁸¹ See IPCC, CLIMATE CHANGE AND BIODIVERSITY, *supra* note __, at 17.

⁸² The reintroduction of wolves into Yellowstone illustrates the effects that can be expected from successful migrations. Researchers believe that the wolves, by preying on elk, have set in motion a series of ecological adjustments leading to rejuvenation of aspen stands. In the absence of their natural predator, the grazing elk were suppressing aspen regeneration; whereas, the introduced wolves have not only reduced elk numbers but also have deterred them from entering aspen stands where they are easy targets. See Virginia Morell, *Aspens Return to Yellowstone, With Help from Some Wolves*, 317 SCIENCE 438 (2007).

⁸³ See IPCC, CLIMATE CHANGE AND BIODIVERSITY, *supra* note __, at 16-17. An example already observed is the expansion of the giant Humboldt squid into the coastal waters of central California. Previously known in that area only during periodic El Nino events, which allowed them to ride warm water currents northward from Mexico for temporary foraging on hake, the squid have permanently taken residence as water temperatures are consistently above the squid's lower threshold. See Louis D. Zeidberg and Bruce H. Robinson, *Invasive Range Expansion by the Humboldt Squid, *Dosidicus gigas*, in the Eastern North Pacific*, 104 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 12948 (2007).

3. Human Adaptation Impacts

Just as the primary threats to species before climate change centered around human-induced ecological change, it is likely that human adaptation to climate change will play a leading role in threats to species. Several forms of human adaptation impacts will present the most pernicious of such threats.

Direct Habitat Conversion. Many human communities are likely to find it necessary and possible to migrate to avoid rising sea levels along coastal areas, to relocate agricultural land uses, and to obtain secure water supplies.⁸⁴ These migrations will necessarily involve some conversion of land uses in areas that presently provide suitable ecological conditions for particular species, in some cases at scales sufficient to pose a threat to the species.⁸⁵

Degraded Ecological Conditions. Relocated human communities will likely also introduce ecological degradations from new or amplified pollution, noise, water diversions, and other stresses.⁸⁶ Many human communities, relocated or not, also will implement climate change mitigation and adaptation measures designed primarily to protect human health and welfare, such as coastal flood barriers, which in some cases could threaten ecological conditions for other species. Even planting of forests to sequester carbon could degrade conditions for some species.⁸⁷

Induced Invasions. Human adaptation to climate change is likely to involve spatial relocations, as well as increased flow of goods to new settlement areas, which as in the past are likely to introduce non-native species to local ecosystems, some of which will establish successfully.⁸⁸

To be sure, it can be expected that some species will fare well, perhaps even spectacularly, under climate change. On balance, however, “approximately 20-30% of plant and animal species assessed so far are likely to be at an increased risk of extinction if increases in global average temperatures exceed 1.5-2.5°C.”⁸⁹ Whichever of the foregoing effects takes hold, therefore, and whenever and wherever they threaten a particular species, it seems beyond question that the ESA has a busy future in store. The next section grounds that assessment in practical policy terms for the FWS.

III. THE IMPACT OF CLIMATE CHANGE ON THE ESA

Recently, the director of the National Aeronautics and Space Administration opined that while he has “no doubt that...a trend of global warming exists,” he is “not so sure that it is fair to

⁸⁴ See Norman Meyers, *Environmental Refuges in a Globally Warmed World*, 43 *BIOSCIENCE* 752 (1993).

⁸⁵ See IPCC, *CLIMATE CHANGE AND BIODIVERSITY*, *supra* note __, at 3-4.

⁸⁶ See IPCC, *CLIMATE CHANGE AND BIODIVERSITY*, *supra* note __, at 42-43.

⁸⁷ See IPCC, *CLIMATE CHANGE AND BIODIVERSITY*, *supra* note __, at 36.

⁸⁸ The U.S. Environmental Protection Agency has suggested that “important progress has been made in identifying climate change effects on invasive species, but that our understanding of effects on specific species and interactions of other stressors needs to be improved.” U.S. Environmental Protection Agency, *Effects of Climate Change on Aquatic Invasive Species and Implications for Management and Research*, 72 Fed. Reg. 45046 (Aug 10, 2007) (notice of availability of research report). Most invasive species introductions are human-induced. See Peter M. Vitousek et al., *Biological Invasions as Global Environmental Change*, 84 *AM. SCIENTIST* 468 (1996).

⁸⁹ IPCC, *CLIMATE CHANGE IMPACTS SUMMARY*, *supra* note __, at 8.

say that it is a problem we must wrestle with.”⁹⁰ His reasons for advocating inaction included that it is “not within the power of human beings to assure that the climate does not change” and that, in any event, it is “arrogant” for us today to decide “that the particular climate we have right here today, right now, is the best climate for all other human beings.”⁹¹ That, of course, is one view, and it suggests a limited role for the ESA in the development of climate change policy.

At the other extreme, scientists from the World Wildlife Fund argue that “the most direct way to protect the ecosystems in which [endangered] species live—the mandate of the ESA—will be to address the cause of climate change: greenhouse gas emissions,” and that “it is important that we also consider how implementation of the ESA can be used to reduce the vulnerability of imperiled species and aid in their recovery despite changing conditions.”⁹² This view suggests a much larger role for the ESA.

Both views, and every position between them, present complex policy considerations owing to the radical nature of climate change as a disruptor of settled regulatory environments. With this imminent reshuffling of regulatory context, the FWS is on the brink of having to make potentially transformative policy choices for the ESA.

A. Reshuffling the Regulatory Landscape

The ESA instructs the FWS to use the regulatory powers it confers on the agency to “provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved.”⁹³ Achieving this primary statutory goal presents in itself difficult questions of policy discretion. That this is the statute’s primary goal is beyond doubt, but how precisely to use the agency’s regulatory discretion to “provide a means” of achieving the goal is not self-evident from the text of the statute. Add to that the presence of secondary goals sprinkled here and there in the statute, such as the command that the FWS “shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species”⁹⁴ and that designation of critical habitat for species must take “into consideration the economic impact, the impact on national security, and any other relevant impact,”⁹⁵ and the agency is confronted with yet another layer of policy balancing. Indeed, the FWS has endured nearly constant scrutiny in Congress and the courts over how it has executed the ESA’s primary and secondary goals.⁹⁶

Alas, the balancing act does not end there for the agency. An important driver of policy discretion under the ESA has for decades been the background social, economic, and legal context within which the statute is situated. The “pit-bull” reputation the ESA has earned over

⁹⁰ Donald Kennedy, *Mixed Messages About Climate*, 317 *Science* 169 (2007) (quoting Michael Griffin from radio interview with National Public Radio, the transcript of which is available at www.npr.org/about/press/2007/053107).

⁹¹ *Id.*

⁹² Lara Hanson and Christopher R. Pyke, *Climate Change and Federal Environmental Law*, SUSTAINABLE DEVELOPMENT LAW & POLICY, Winter 2007, at 26, 27.

⁹³ 16 U.S.C. § 1531(b).

⁹⁴ 16 U.S.C. § 1531(c)(2).

⁹⁵ 16 U.S.C. § 1533(b)(2).

⁹⁶ For an overview of the pressures FWS has faced in this respect, including demands on the one hand that it be more ‘precautionary’ and on the other hand that it be more ‘scientific,’ see J.B. Ruhl, *The Battle Over Endangered Species Act Methodology*, 34 ENVTL. L. 555 (2004).

time has come at some cost, as the statute is often portrayed as unduly interfering with property rights, susceptible to unscientific agency biases, and riddled with irrational fiscal outcomes. It is, to put it mildly, not well liked in some quarters, and at some junctures in its history those who deride the statute have been in a position to do something about it. For example, by the mid-1990s the ESA had reached a low-point in the Republican-controlled Congress, where the statute had become a whipping boy for property rights and “sound science” advocates.⁹⁷ Adeptly, however, then-Secretary of the Interior Bruce Babbitt spearheaded a series of policy reforms designed to forge a two-part agenda of promoting species conservation while nonetheless responding to the concerns being voiced in opposition to the statute. One side of the agenda focused on enhancing species conservation through greater emphasis of ecosystem-level management of habitat and other resources vital to the sustainability of imperiled species.⁹⁸ The other side of the agenda focused on confirming the science-based mission of the statute and providing greater voice and fairness to landowners on whose property imperiled species are found.⁹⁹ Over time this double-barreled agenda took many forms and led to numerous regulatory innovations.¹⁰⁰ Implementing this strategy, however, depended on innovative interpretations of ESA authorities and the extent of agency discretion,¹⁰¹ the very kind of exercise climate change may force on the agency once again.

The FWS thus has been in the policy balancing game for some time, working where it can to keep the primary and secondary statutory goals in line and the overall statutory profile in harmony with the relevant background policy context. So what is new about climate change for an agency already seasoned in the exercise of policy balancing? Everything. Climate change does not fit into one of the familiar policy realms, affecting the policy balance by operating from within the existing set of trade-offs. Rather, climate change operates on all three realms at once, disrupting not only the contents of each, but also how the trade-off dynamics between each realm play out. The ESA’s primary goal of species conservation will be challenged by the primary, secondary, and human adaptation effects of climate change. The ESA’s secondary goals, such as economic practicability and water resources management, will face their own set of climate change challenges. And the background policy context of property rights, scientific norms, agency performance, fiscal constraints, and other concerns will also evolve as climate change places broad pressure on the economy and society. How the FWS balances between these three dissembling realms of policy attention inevitably will change as well, as the agency will have had no prior experience with the emerging set of relationships.

⁹⁷ For comprehensive and thoughtful “insider” accounts of the fate of the ESA in this period, see John D. Leshey, *The Babbitt Legacy at the Department of Interior: A Preliminary View*, 31 ENVTL. L. 199 (2001); Joseph L. Sax, *Environmental Law At the Turn of the Century; A Reportorial Fragment of Contemporary History*, 88 CAL. L. REV. 2375 (2000).

⁹⁸ See, e.g., FWS and NMFS, Interagency Policy for the Ecosystem Approach to the Endangered Species Act, 59 Fed. Reg. 34,274 (July 1, 1994); George Frampton, *Ecosystem Management in the Clinton Administration*, 7 DUKE ENVTL. L. & POL’Y F. 39 (1996) (authored by DOI official).

⁹⁹ See J.B. Ruhl, *Who Needs Congress? An Agenda for Administrative Reform of the Endangered Species Act*, 6 NYU ENVTL. L.J. 367, 388-400 (1998) (contemporary survey of policies serving this purpose).

¹⁰⁰ For a retrospective summary of the full effect of the Babbitt-era reforms, see J.B. Ruhl, *Endangered Species Act Innovations in the Post-Babbittian Eras—Are There Any?*, 14 DUKE ENVTL. L. & POL’Y F. 419, 430-34 (2004).

¹⁰¹ Once again, an insider’s account provides a thoughtful perspective on the strategic approach the Babbitt administration took. See Leshey, *supra* note ___, at 212-14.

In short, just as climate change will reshuffle ecosystems, it will reshuffle the policy context of regulatory programs such as the ESA. Babbitt tested the policy limits of the ESA against fairly well-defined constraints and complaints that boiled down, for the most part, to politics. In the climate change era, by contrast, what will qualify as scientifically credible, fiscally sound, attentive to property rights, and a means of conserving species is uncharted territory for Congress, the courts, and the agency alike. Politics will matter, but the physical world will matter more.

B. Focal Points for Policy Choices

Where are the pervasive, transformative policy implications of climate change most likely to place pressure on administration of the ESA? Like the EPA, after *Massachusetts v. EPA* the FWS surely will find itself hemmed in from taking the positions that climate change is not occurring or has no anthropogenic causal component. Unlike where the Clean Air Act takes the EPA, however, accepting that human-induced climate change is occurring does not lead inevitably to particular administrative duties or findings under the ESA. No provision of the ESA addresses pollutants, emissions, or climate in any specific regulatory sense. Rather, the statute operates on fairly holistic levels, requiring the FWS to consider what constitutes endangerment, take, jeopardy, and recovery of species. Far from insulating the FWS from the need to test the range of its discretion, however, the general nature of the ESA will thrust the FWS into several key policy quagmires.

Identifying Climate-Threatened Species. As no regulatory authorities of the ESA operate until a species is listed as endangered or threatened under section 4 of the ESA, the initial pressure point is likely to be how the FWS uses available science to determine the effects of climate change on particular species. Identifying climate change as a basis for listing a species is likely to invite charges from industry that the agency is using weak models and sparse data, whereas declining to list a species for which a plausible case of climate threat can be made is likely to invite claims from environmental groups that the agency is ignoring the science.

Regulating Greenhouse Gas Emissions. If the FWS identifies climate change as a basis for designating a species for protection under the ESA, it inevitably will face the question whether federal actions that cause, fund, or authorize greenhouse gas emissions jeopardize the species under section 7, and whether any person emitting greenhouse gases is taking the species in violation of section 9.¹⁰² Weak regulation of emissions would ignore the evidence that they are the primary human activity directly contributing to climate change, whereas strong regulation would run into complicated cause-and-effect issues, not to mention potentially caustic political battles.

Regulating Non-Climate Effects to Protect Climate-Threatened Species. Regardless of how aggressively the FWS attempts to regulate greenhouse gas emissions to protect a climate-

¹⁰² Some environmental advocacy groups have made no bones about their intention to pursue litigation forcing the FWS and NMFS to regulate greenhouse gases in order to protect climate-threatened species and their designated critical habitat areas. For example, the Center for Biological Diversity believes that the designation of critical habitat for several species of climate-threatened corals “actually moves the entire Endangered Species Act onto a firm legal foundation for challenging global-warming pollution.” See Mark Clayton, *New Toll to Fight Global Warming: Endangered Species Act?*, *Christian Science Monitor*, Sept. 7, 2007, p. 3, sec. 3, available at <http://www.csmonitor.com/2007/0907/p03s03-usgn.html> (quoting Kieran Suckling, Policy Director of the Center for Biological Diversity).

threatened species, it inevitably will face the problem of how aggressively to regulate other actions that injure the species but which do not contribute to climate change, such as habitat conversion, water diversion, and pollution. Indeed, the agency will face this question even if it adopts the position that climate change is purely natural in cause. For species imperiled primarily because of climate change, however, regulating human activities having no climate change impacts could be controversial and, in the final analysis, futile.

Designing Conservation and Recovery Initiatives. As the FWS regulates more activities associated with climate-threatened species, it inevitably will face the need to design conservation measures as conditions for approval of incidental take under sections 7 and 10, as well as the need to formulate recovery measures for the species under section 4. The long-term effectiveness of such measures, however, will be thrown into question as rising sea levels, rising temperatures, and the general reshuffling of ecosystems alter the underlying premises used to design them.

Species Trade-Offs. As noted above, the ESA depends on an overriding purpose of “provid[ing] a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.”¹⁰³ Yet the reshuffling of species under climate change conditions will make it difficult to identify “the ecosystems” to be conserved and is likely to pit species against species even more so than has been confronted thus far in nature and under the ESA.¹⁰⁴ Can the FWS reasonably hope to defy climate change and keep existing ecological regimes intact, or should it follow where the reshuffling leads and work toward conserving the new order?

Dealing with the Doomed. Perhaps the most confounding question for the FWS will be how to respond with respect to species that by all appearances are doomed because of lack of migratory and adaptive capacity to withstand climate change effects in their natural habitat range. Should the FWS to assist such species if it means relocating them to areas climate change has altered in such a way as to provide suitable habitat? If so, how must the agency take into account the consequences of assisted migration on other species? Or, if the doomed are left where they are, must the agency expend resources protecting them, or can they be ignored?

These six areas define the core of the ESA: which species to protect; which threats to regulate; how to help. Left to its own choice, the FWS might decide to downplay climate change as a factor in all these respects, to integrate it aggressively, or to mix and match according to a menu of objectives and depending on a variety of criteria. The agency might decide, for example, that identifying all species plausibly threatened by climate change is a salutary use of the ESA, but that expending regulatory authority on those species threatened primarily by climate change—the doomed—is unwise. Or it may decide that the “pit-bull” version of the ESA is the nation’s most promising mechanism for going after the large emitters of greenhouse gases. The point, however, is that the choice is not all for the FWS to make. Before turning to what the FWS ought to do, we must consider what it can do.

¹⁰³ 16 U.S.C. § 1531(b).

¹⁰⁴ Obviously, species naturally compete with one another, such as for habitat and food, or conflict as predator and prey. There are also a number of examples in which conservation measures taken to benefit a species protected under the ESA pose adverse effects for other species protected under the ESA or for other species generally. See NATIONAL RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT 111-23 (1995).

IV. FITTING AGENCY DISCRETION WITH CLIMATE CHANGE

Climate change will inevitably rear its head in several ESA programs, the question being whether the FWS will attempt to use what discretion it has to use it to its fullest as a regulatory mechanism or to minimize its role in decision making. But what is the extent of the agency's discretion—how passive or aggressive can it choose to be? The petitioners who have sought rulemaking changes to address climate change under the ESA “believe that existing law and regulations already *require* the...consideration of global warming in all relevant decisions,” but do not explain the basis for that assertion in their petition.¹⁰⁵ Keeping the five policy points outlined above in mind, therefore, this section examines the extent of the agency's discretion in the listing programs found in section 4 of the statute, three regulatory programs—the take prohibition, the jeopardy consultation program, and the HCP permit program—and under the statute's pervasive “best scientific data available” standard for decision making.

A. Section 4: Listing, Critical Habitat, and Recovery Plans

Section 4 establishes a package of programs aimed identifying imperiled species: (1) the listing function, through which such species are identified as endangered or threatened; (2) the designation of critical habitat essential for the survival of such species; and (3) a planning function designed to identify the steps needed for their recovery. Each program presents the FWS with junctures of narrow and broad discretion with respect to climate change.

1. Identifying Species

Section 4(a)(1) of the ESA requires the FWS to determine whether any species is an endangered species or a threatened species because of any of the following factors:

- (A) the present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) overutilization for commercial, recreational, scientific, or educational purposes;
- (C) disease or predation;
- (D) the inadequacy of existing regulatory mechanisms;
- (E) other natural or manmade factors affecting its continued existence.¹⁰⁶

There could hardly be a more definitive mandate to consider the effects of greenhouse gas emissions and climate change on species. Greenhouse gas emissions are unquestionably a “manmade factor,” and if as abundant evidence suggests they are contributing to climate change, they are potentially “affecting...[the] continued existence” of climate-threatened species. Regardless of their causal agents, atmospheric warming, sea level rise, and other primary ecological effects of climate change involve “the destruction, modification, or curtailment of...[species'] habitat or range,” and the ecological reshuffling effects of climate change contribute to secondary ecological effects such as “disease or predation.” Like the EPA under the

¹⁰⁵ See Petition for Rulemaking, *supra* note ___, at 3 (emphasis added).

¹⁰⁶ 16 U.S.C. § 1533(a)(1). The state also requires that the FWS “shall make determinations required by subsection (a)(1) solely on the basis of the best scientific and commercial data available to him after conducting a review of the status of the species.” *Id.* & 1533(b)(1)(a). I address the “best scientific data available” standard *infra* in Part IV.E.

Clean Air Act, therefore, the FWS seems stuck with the challenge of identifying which species are endangered or threatened partly or primarily because of climate change. The pika, which is not yet listed as endangered or threatened, should be at the front of this line.

Yet there is considerable flexibility for the agency even so. For example, a species is endangered if it is “in danger of extinction throughout all or a significant portion of its range”¹⁰⁷ and is threatened if it “is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.”¹⁰⁸ These are not precise concepts. For example, what does “all or a significant portion of its range” mean? One court recently described the passage as “odd phraseology” and an “enigmatic phrase,”¹⁰⁹ 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 the FWS what the lawyers believe this phrase means.¹¹⁰ Between that and “in danger of,” “is likely to,” and “foreseeable future,” and the FWS may not be so hemmed in after all. Given the extent of agency expertise that must necessarily go into making such judgments, the FWS likely has considerable play in terms of matching different climate change threat scenarios with the ESA’s endangered-threatened-not threatened matrix. Indeed, the agency thus far has weaved between these terms and used its agency expertise and administrative discretion to find climate change a factor in some cases and not in others.¹¹¹ Some species may present such compelling cases of climate change threat that even aggressive use of discretion could not support a decision not to list, but many will present more ambiguous scenarios.

Another source of discretion in the listing function rests in section 4(d), which provides:

Whenever any species is listed as a threatened species pursuant to subsection (c) of this section, the Secretary shall issue such regulations as he deems necessary and advisable to provide for the conservation of such species. The Secretary may by regulation prohibit with respect to any threatened species any act prohibited under section 9(a)(1), in the case of fish or wildlife, or section 9(a)(2), in the case of plants, with respect to endangered species.¹¹²

In an article illustrating the interplay between this authority and the regulatory provisions of the ESA, Madeline June Kass has explained how Section 4(d) of the statute provides considerable regulatory flexibility.¹¹³ When animal species are listed as endangered, the “take”

¹⁰⁷ 16 U.S.C. § 1532(6)

¹⁰⁸ 16 U.S.C. § 1532(19)

¹⁰⁹ *Defenders of Wildlife v. Norton*, 258 F.3d 1136 (9th Cir. 2001).

¹¹⁰ Memorandum from Solicitor, U.S. Department of the Interior, to Director, U.S. Fish and Wildlife Service Re: The Meaning of “In Danger of Extinction Throughout All or a Significant Portion of its Range” (March 16, 2007).

¹¹¹ For example, unlike its conclusions thus far for the polar bear and penguins, the agency was unconvinced that the American eel is endangered as a result of the effects climate change has had on ocean conditions, notwithstanding ample evidence that the effects are real and posing imminent threats to the species. Compare U.S. Fish & Wildlife Serv., 12-Month Finding on a Petition to List the American Eel as Threatened or Endangered, 72 Fed. Reg. 4967 (Feb. 2, 2007) (rejecting a listing petition “because oceanic conditions are within normal variations [and] the American eel is evolutionarily adapted to oceanic variations”), with Thierry Wirth and Louis Bernatchez, *Decline of North Atlantic Eels: A Fatal Synergy?*, 270 PROCEEDINGS OF THE ROYAL SOCIETY OF LONDON 681 (2003) (compiling evidence of threats from changing oceanic conditions associated with climate change).

¹¹² 16 U.S.C. § 1533(d).

¹¹³ See Madeline June Kass, *Threatened Extinction of Plain Vanilla 4(d) Rules*, 16 NAT. RESOURCES & ENV’T 78 (Fall 2001).

prohibition of section 9 applies automatically and fully, leaving less discretion to the FWS as to how to regulate activities that might cause take of the species. By contrast, under Section 4(d) the FWS has the discretion to prescribe the level of take protection afforded species listed as threatened. Kass describes how the FWS (as has its sister agency, the NMFS) has increasingly turned to this option as a means of relieving the angst associated with Section 9, by crafting complex rules under Section 4(d) detailing activities that are and are not prohibited under Section 9.¹¹⁴

This option may prove especially useful for the FWS with respect to a climate-threatened species, allowing the FWS to identify and regulate the specific effects of human adaptation to climate change that pose significant obstacles to the survival and recovery of the species, whereas broad, dispersed actions such as greenhouse gas emissions could be entirely excluded from regulation. Indeed, the FWS has proposed to list the polar bear as threatened, and has suggested it might employ this approach.¹¹⁵ Of course, the success of this strategy depends on there being scientific credibility for designating the species as threatened. Moreover, the condition that protective regulations be “necessary and advisable to provide for the conservation of such species” has not been tested in a context like that suggested—i.e., to exclude one set of causal factors, ostensibly because the cause, effect, and response associated with them is so complex, so as to focus conservation resources on a more manageable set of factors. Not surprisingly, therefore, this new approach, while “creative and fresh,”¹¹⁶ is controversial, and would no doubt prove doubly so if used as suggested for dealing with climate-threatened species.

2. Designating Critical Habitat

Section 4(a) of the ESA also requires that, “to the maximum extent prudent and determinable [the FWS] shall concurrently with making a determination under paragraph (1) that a species is an endangered species or a threatened species, designate any habitat of such species which is then considered to be critical habitat.”¹¹⁷ The statute defines critical habitat to mean

- (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
- (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the [FWS] that such areas are essential for the conservation of the species.¹¹⁸

The critical habitat program has proven quite controversial. In addition to a wave of suits involving missed statutory deadlines for critical habitat designations, “both the protection provided by and the analysis required for critical habitat designation are coming under increased

¹¹⁴ See *id.* at 79-81.

¹¹⁵ See 72 Fed. Reg. 1064, 1097 (Jan. 9, 2007).

¹¹⁶ Kass, *supra* note ___, at 133.

¹¹⁷ 16 U.S.C. § 1533(a)(3)(A).

¹¹⁸ 16 U.S.C. § 1532(5)(A).

judicial scrutiny.”¹¹⁹ Nevertheless, in the case of climate change the critical habitat program could lend considerable flexibility to the FWS in several respects.

On the one hand, the provision allowing designation of specific areas outside the geographical area occupied by the species at the time it is listed if they are essential for the conservation of the species may be an ideal way for FWS to respond aggressively to ecological reshuffling. To the extent downscale models can predict with reasonable certainty where a species might successfully migrate to adapt to changes brought about by climate change, the agency could “reserve” those areas through critical habitat designations.¹²⁰ This would provide an effective signal to human adaptation measures to minimize effects in such areas, thus securing a greater chance for the species to withstand climate change transitions and establish a viable population in its new ecological home.

On the other hand, several provisions also open the door to a passive approach. For example, the agency could justifiably conclude that designation of critical habitat for species doomed by climate change fails to meet the “prudent” standard, as it will provide no benefit.¹²¹ Indeed, for a doomed species arguably there is no habitat “essential to the conservation of the species,” as conservation of the species is not possible. Even for species that might be assisted through critical habitat designation, determining critical habitat in a period of ecological change could be so difficult as to make it “indeterminable,”¹²² which would delay the time by which critical habitat must be designated by up to one year after the species is listed.¹²³

¹¹⁹ See Murray D. Feldman and Michael J. Brennan, *The Growing Importance of Critical Habitat for Species Conservation*, 16 NAT. RESOURCES & ENV'T 88, 88 (Fall 2001). The wave of litigation has become so intense and costly, FWS has described it as having nothing short of debilitating effects on the agency's ability to carry out its conservation mission. The agency has long believed that, in most circumstances, the designation of “official critical habitat is of little additional value for most listed species, yet it consumes large amounts of conservation resources, and that that the present system for determining and designating critical habitat is not working.” U.S. Fish & Wildlife Serv., Notice of Intent To Clarify the Role of Habitat in Endangered Species Conservation, 64 Fed. Reg. 31871, 31872 (June 14, 1999).

¹²⁰ FWS took an approach like this with respect to the Preble's meadow jumping mouse, deciding to include small streams in the species' critical habitat, even though larger streams are more important to the species, on the ground that “Preble's populations along mountain streams may be less subject to certain threats including...long-term climate change.” U.S. Fish & Wildlife Serv., Designation of Critical Habitat for the Preble's Meadow Jumping Mouse, 68 Fed. Reg. 37267, 37285 (June 23, 2003). On the other hand, it declined to do so for the Spreading navarretia plant. A commenter suggested that the critical habitat should “include areas of unoccupied suitable habitat that would provide for recovery opportunities, including...migration in response to climate change,” but the agency merely observed that “critical habitat designations do not signal that habitat outside the designation is unimportant or may not be required for recovery.” U.S. Fish & Wildlife Serv., Designation of Critical Habitat for Navarretia Fossalis (Spreading Navarretia), 70 Fed. Reg. 60658, 60662 (Oct 18, 2005).

¹²¹ The statute does not define “prudent.” According to FWS regulations, designation of critical habitat is not prudent if it “would not be beneficial to the species.” 50 C.F.R. § 424.12(a)(1)(ii). Courts have examined “not prudent” determinations by the FWS with a “hard look” review demanding more than conclusory statements and expecting that such determinations will be rare. See LIEBESMAN & PETERSEN, *supra* note __, at 20-21; STANFORD ENVIRONMENTAL LAW SOCIETY, *supra* note __, at 64-66.

¹²² The statute does not define “indeterminable.” According to FWS regulations, critical habitat is indeterminable if “information sufficient to perform required analyses of the impacts of the designation is lacking [or] the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.” 50 C.F.R. § 424.12(a)(2). This is the position the FWS has taken thus far with respect to the polar bear. See 72 Fed. Reg. 1064, 1096 (Jan. 9, 2007).

¹²³ See 16 U.S.C. § 1533(b)(6)(C). At the end of that year critical habitat must be designated “to the maximum extent prudent.” *Id.*

In addition, the statute specifies that the FWS “shall designate critical habitat, and make revisions thereto, under subsection (a)(3) on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impact, of specifying any particular area as critical habitat.”¹²⁴ Based on this analysis, the agency “may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned.” The FWS could put together a credible case that a designation of critical habitat for a climate-threatened species might so extensively impede human adaptation to climate change as to warrant exercise of this discretion, so long as the case also can be made that extinction is not therefore inevitable.

3. Formulating Recovery Plans

Section 4(f) of the ESA requires the FWS to “develop and implement plans (hereinafter in this subsection referred to as “recovery plans”) for the conservation and survival of endangered species and threatened species listed pursuant to this section, unless [FWS] finds that such a plan will not promote the conservation of the species.” The agency must also “give priority to those endangered species or threatened species, without regard to taxonomic classification, that are most likely to benefit from such plans, particularly those species that are, or may be, in conflict with construction or other development projects or other forms of economic activity.” Arguably, this prioritization mandate speaks directly to climate-threatened species which, perhaps only with the help of the ESA, could survive the transition to stabilized climate regimes. On the other hand, one striking aspect of the recovery plan program is that it specifically relieves the FWS of any duty to prepare a plan if the agency finds that “a plan will not promote the conservation of the species.” For a species essentially doomed by climate change through stranding or other extreme effects, the FWS could justifiably reach such a finding and avoid expending agency resources developing a plan for the species.

Even if the FWS does prepare a recovery plan for a climate-threatened species, presumably on the premise that the ESA can help the species, it will be of limited application as the courts have interpreted recovery plans to have no mandatory effect on federal agencies, much less anyone else.¹²⁵ They are plans, and that’s it.

Nevertheless, recovery plans are not necessarily meaningless. They do provide a wealth of information about a species and its road to recovery.¹²⁶ Although Professor Federico Cheever has

¹²⁴ 16 U.S.C. § 1533(a)(3)(A). I address the “best scientific data available” standard *infra* in Part IV.E.

¹²⁵ See LIEBESMAN & PETERSEN, *supra* note __, at 25-26; STANFORD ENVIRONMENTAL LAW SOCIETY, *supra* note __, at 76-77.

¹²⁶ For example, the FWS must incorporate in each plan-

- (i) a description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species;
- (ii) objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of this section, that the species be removed from the list; and
- (iii) estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal.

16 U.S.C. 1533(f)(1)(B).

meticulously chronicled the failure of recovery planning to amount to anything in terms of force of law,¹²⁷ he also has outlined the case for using recovery plans to guide implementation of the other ESA programs, including those that do have regulatory force. His argument points to the influence recovery plans have had on judicial determinations of such matters as whether an activity causes take, whether an activity jeopardizes a species, and whether a species should be reclassified from endangered to threatened.¹²⁸ Moreover, recovery plans can help motivate and guide state, local, and private collaborative efforts to respond to effects of climate change on the species.¹²⁹ Through recovery plans, therefore, the FWS may be able to influence how climate change effects are viewed for species in the regulatory programs of the ESA—the take prohibition, the jeopardy consultation program, and the HCP permit program—which are taken up in the next three sections of the Article.

B. Section 9: The Take Prohibition

Section 9(a)(1) of the ESA instructs that, except as provided elsewhere in the ESA,¹³⁰ “with respect to any endangered species of fish...it is unlawful for any person subject to the jurisdiction of the United States to...(B) take any such species within the United States or the territorial sea of the United States.”¹³¹ Recognizing that this so-called “take prohibition” has defined limits—it does not apply to plant species¹³² and does not apply automatically to threatened species of fish and wildlife¹³³—where it applies it does so sweepingly and with tremendous force. Persons subject to the prohibition include all federal, state, and local governments and all private organizations and individuals.¹³⁴ It applies “within the United States,” on public and private lands alike. And it applies to acts that “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” the protected species.¹³⁵ Within that list of prohibited activities, FWS and NMFS have defined “harm” to include any modification of the species’ habitat—in this case not limited to designated critical habitat—that results in “actual death or injury” to species members “by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.”¹³⁶ Although that the United States Supreme Court upheld this interpretation of the statute in *Babbitt v. Sweet Home Chapter of Communities for a Great Oregon*,¹³⁷ the devil is in the details in this instance.

¹²⁷ See Federico Cheever, *Recovery Planning, the Courts and the Endangered Species Act*, 16 NAT. RESOURCES & ENV’T 106, 108-110 (Fall 2001).

¹²⁸ See *id.* at 110-11, 135.

¹²⁹ See, e.g., National Marine Fisheries Serv., Proposed Recovery Plan for the Evolutionarily Significant Unit (ESU) of the Puget Sound Chinook Salmon, 70 Fed. Reg. 76445, 76447 (Dec. 27, 2005) (integrating climate change effects in the recovery plan can “support recovery actions to protect and restore local habitat conditions as a buffer against larger-scale changes”).

¹³⁰ The incidental take permitting program is one such exception. See *infra* Part IV.D.

¹³¹ 16 U.S.C. 1538(a)(1).

¹³² Plants receive more limited protection. See 16 U.S.C. 1539(a)(2).

¹³³ As noted *supra* in Part IV.A.1, the listing agency may by rule extend some or all of the take prohibition protections to threatened species. 16 U.S.C. 1533(d).

¹³⁴ All these entities fit the ESA’s definition of “person.” See 16 U.S.C. 1532(13).

¹³⁵ 16 U.S.C. 1532(19).

¹³⁶ 50 C.F.R. 17.3 (FWS definition); 50 C.F.R. part 217 (NMFS definition).

¹³⁷ 515 U.S. 687 (1995).

The *Sweet Home* opinion took with one hand while it gave with the other, limiting the breadth of the harm definition as much as it upheld the idea that take extends to habitat losses. The harm definition projects the take prohibition from cases in which the action causes direct death or injury (e.g., hunting, shooting, and trapping), to cases in which an indirect causal chain is present—i.e., loss of habitat leads in some way to actual death or injury. But theories of indirect take causation can become quite attenuated and speculative, in which case it would be unreasonable to enforce the take prohibition’s rebuttable presumption against the activity as rigorously as in more obvious cases of direct take. For example, assume that a developer’s plan to build a subdivision would locate new homes in an area within several hundred yards of habitat known to be occupied by members of a protected bird species, but not in the habitat. Opponents of the project may argue that some of the residents of the new homes will have cats as pets, some of those cat owners will allow their cats to wander outdoors, some of those cats may venture into the bird’s habitat, and some of those cats may eat birds, and some of those birds may be individuals of the protected bird species. Anyone could speculate such possibilities, and it would be unreasonable to impose the burden on the developer of proving the postulated scenario is not possible.¹³⁸

Rather, as the Court pronounced when it upheld the harm definition, in many cases it is appropriate to impose the burden of proof on the proponent of the indirect harm theory. Thus, the majority emphasized that the harm rule incorporates “but for” causation, with “every term in the regulation’s definition of ‘harm’ . . . subservient to the phrase “an act which actually kills or injures wildlife,”¹³⁹ and as well must “be read to incorporate ordinary requirements of proximate causation and foreseeability.”¹⁴⁰ The majority thus endorsed “strong arguments that activities that cause minimal or unforeseeable harm will not violate the [ESA] as construed.”¹⁴¹ In her concurrence, Justice O’Connor was more direct, limiting the scope of the harm rule to “significant habitat modification that causes actual, as opposed to hypothetical or speculative, death or injury to identifiable protected animals.”¹⁴² Since the Court established these tort-like evidentiary burdens, the lower courts have steadfastly refused to enforce the take prohibition based on attenuated indirect take theories, but have enjoined case-specific instances of take when death or injury was proven to be likely.¹⁴³

The stiff evidentiary and proof burdens *Sweet Home* imposed largely explain why the government and citizen groups (through citizen suits) so infrequently attempt to prosecute take violation claims.¹⁴⁴ Prosecuting a climate change case would be no mean feat either, given the

¹³⁸ See *Morrill v. Lujan*, 802 F. Supp. 424 (S.D. Ala. 1992) (rejecting ESA claim for injunctive relief based on this set of allegations). In settlement of another round of litigation initiated following the denial of the injunction request, the developer in *Morrill* nonetheless agreed to prohibit house cats in the development. See William H. Satterfield et al., *Who’s Afraid of the Big Bad Beach Mouse?*, NAT. RESOURCES & ENV’T, Summer 1993, at 13, 15.

¹³⁹ 515 U.S. at 700 n.13.

¹⁴⁰ 515 U.S. at 696-97 n.9.

¹⁴¹ 515 U.S. at 699.

¹⁴² 515 U.S. 708-09.

¹⁴³ For a current and thorough survey of the post-*Sweet Home* cases, see Alan M. Glen and Craig M. Douglas, *Taking Species: Difficult Questions of Proximity and Degree*, 16 NAT. RESOURCES & ENV’T 65 (2001).

¹⁴⁴ The handful of reported cases involving land uses are covered in Glen & Douglas, *supra* note ___. As they show, most section 9 enforcement cases are brought by citizen groups under the citizen suit provision of the ESA. A rare example of federal government prosecution is *United States v. Town of Plymouth*, 6 F. Supp. 2d 81 (D. Mass. 1998), in which the government sued a city for failing to prevent its citizens from running over a small endangered bird while riding ORVs along a public beach. The FWS and citizen groups have also prosecuted a number of section

generic effects of greenhouse gas emissions and the imprecision of downscaling models. Consider, for example, a scenario in which the pika is listed as endangered due to climate change. Who is taking the pika? Are greenhouse gas emissions from, say, a coal-fired power plant in Florida taking the pika? The plaintiff in such a case would have to show that the power plant emissions are the actual as well as proximate, foreseeable cause of the primary and secondary ecological effects which are in turn the actual as well as proximate, foreseeable cause of the pika's demise.¹⁴⁵ Proving that would prove too much, however, as it would necessarily follow that *all* sources of greenhouse gases are taking the pika. This is an inherent feature of the take prohibition that makes it inapposite when take of a species occurs through large-scale, dispersed causal agents, such as water consumption and pollution—if *anyone* is taking the species, *everyone* is taking the species. Although nothing in the ESA prevents the FWS from attempting to prosecute such a case, it would be a daunting prosecutorial undertaking¹⁴⁶ as well as likely political suicide.¹⁴⁷ Thus far the FWS has exhibited no stomach for it,¹⁴⁸ and in the long

9 cases against water diverters in western states. See James Rasband, *Priority, Probability, and Proximate Cause: Lessons from Tort Law About Imposing ESA Responsibility for Wildlife Harm on Water Users and Other Joint Habitat Modifiers*, 33 ENVTL. L. 595 (2003).

¹⁴⁵ Even the Center for Biological Diversity, which has proclaimed a “push to use the ESA to fight global warming,” concedes that “any bid to fight the construction of a power plant by arguing that emissions might harm a species would probably be thrown out of court, because such climate-change effects remain speculative.” Clayton, *supra* note __, at 3 (reported summary of an interview with Kieran Suckling, Policy Director of the Center for Biological Diversity). Difficulties in establishing actual and proximate causation permeate legal analyses of tort and other liabilities associated with climate change. See David A. Grossman, *Warming p to a Not-So Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENVTL. L. 1 (2003).

¹⁴⁶ The difficulty of prosecuting take prohibition claims in such dispersed take scenarios has led some plaintiffs to simplify matters by suing state and local governments that allegedly “authorize” the behavior under state or local law. For example, if a state authorizes boating in state waters inhabited by an endangered species, the claim would be that the state is vicariously liable for the injuries the boaters cause to the species. This strategy is, not surprisingly, controversial and has had mixed results in the courts. See J.B. Ruhl, *State and Local Government Vicarious Liability under the ESA*, 16 NATURAL RESOURCES & ENV'T 70 (Fall 2001). It has never been applied successfully on a scale remotely approaching global greenhouse gas emissions.

Another approach to simplify take prosecutions in dispersed aggregate causation settings could be to single out only major sources of harm for prosecution seeking injunctive relief. For example, in the western water diversion context, which often presents multiple diverters having an aggregate impact on an aquatic species, the FWS or other plaintiff might select major water diverters as the defendants to enjoin their future diversion of water. Professor James Rasband criticizes this approach to the extent it follows anachronistic tort principles of joint and several liability with no right of contribution. He suggests instead using apportioned injunctive relief based on each defendant's priority of diversion under the western appropriative rights system. See Rasband, *supra* note __, at 637-44. As he points out, however, as the number of diverters increases and the proportionate diversion of any one decreases, more and more diverters must be joined in the suit in order to make a dent on total diversion of water from the aquatic ecosystem. See *id.* at 641-42. This effect would be particularly acute in the case of greenhouse gas emissions. Neither joint and several liability nor apportioned liability has been employed as a theory of liability in a section 9 prosecution based on greenhouse gas emissions as the alleged causal agent.

¹⁴⁷ See Rasband, *supra* note __, at 638 (observing that prosecution of take violation cases presents daunting proof complications and is politically unpopular).

¹⁴⁸ For example, the agency does not identify greenhouse gas emissions in the list of activities it believes could potentially result in a violation of section 9 with regard to the polar bear. See 72 Fed. Reg. 1064, 1098 (Jan. 9, 2007).

run may determine to use its discretion—in this case prosecutorial discretion¹⁴⁹—to leave greenhouse gas emissions out of its take enforcement agenda.¹⁵⁰

The take prohibition would prove more manageable to enforce against discrete, identifiable actions that make it less likely a climate-threatened species will survive through the climate change transition. In particular, human adaptation to climate change is likely to present collisions between many species, climate-threatened or not, and human responses such as relocated agricultural and urban land uses, technological structures designed to impede sea level rise and floods, and new and intensified water diversions to sustain parched urban centers. Enforcement of the take prohibition in such settings, where proximate cause may be less difficult to establish, could help ensure that human adaptation measures are not carried out recklessly with respect to the interests of imperiled species. In this sense, section 9 would be used no differently from the way it is already used—climate change effects would simply be a reason to use it more vigilantly.

C. Section 7: Jeopardy Consultations

Section 7(a)(2) of the ESA provides that “each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an “agency action”) is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined...to be critical.¹⁵¹ The statute builds an elaborate procedure for carrying out these consultations under which the agency proposing the action must “consult” with the FWS through a series of steps designed to predict the impact of the action on listed species, with the ultimate product being a “biological opinion” from the FWS “setting forth the [agency’s] opinion, and a summary of the information on which the opinion is based, detailing how the agency action affects the species or its critical habitat.”¹⁵²

The substantive content for conducting the consultation analysis is defined primarily in FWS regulations. Jeopardize is defined there as “to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, number, or distribution of that species.”¹⁵³ Five key regulatory definitions lay out the scope of effects that must be considered to determine whether an action triggers that standard:

Action means “all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or on the high seas.”¹⁵⁴

¹⁴⁹ Prosecutorial discretion is relatively unbounded. *See Heckler v. Chaney*, 470 U.S. 821 (1985).

¹⁵⁰ The FWS cannot generally prevent citizen groups from launching such an enforcement effort, but could do so in specific cases by listing a species as threatened and limiting the scope of the take prohibition with respect to that species, as it is authorized to do under section 4(d) of the statute. *See supra* Part IV.A.1.

¹⁵¹ 16 U.S.C. 1536(a)(2). The provision also requires that “in fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.” *Id.* I address the “best scientific data available” standard *infra* in Part IV.E.

¹⁵² 16 U.S.C. 1536(b)(3)(A).

¹⁵³ 50 C.F.R. § 402.02.

¹⁵⁴ 50 C.F.R. § 402.02.

Effects of the action means “the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline.”¹⁵⁵

Environmental baseline means “the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in progress.”¹⁵⁶

Indirect effects are “those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.”¹⁵⁷

Cumulative impacts are “those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation.”¹⁵⁸

FWS has issued no official guidance on climate change with respect to the Section 7 jeopardy consultation program, but it takes no stretch of imagination to fit climate change in this framework. Consider a project being carried out, funded, or authorized by a federal agency the construction of which will remove habitat of a listed species and the operation of which will emit greenhouse gases. The removal of habitat and emission of greenhouse gas emissions clearly are direct effects of the action added to the environmental baseline, both of which could have indirect effects that adversely affect the species. The habitat removal could at some later time adversely affect the reproduction, number, or distribution of that species. The greenhouse gas emissions contribute to tropospheric warming, the secondary effects of which could also, at some later time, adversely affect the species. Moreover, other state and private activities emitting greenhouse gases may also contribute to cumulative climate change effects that adversely affect the species. In short, greenhouse gas emissions and their climate change consequences both appear to be wrapped tightly into the framework for consultations under section 7(a)(2).¹⁵⁹

¹⁵⁵ 50 C.F.R. § 402.02.

¹⁵⁶ 50 C.F.R. § 402.02.

¹⁵⁷ 50 C.F.R. § 402.02.

¹⁵⁸ 50 C.F.R. § 402.02.

¹⁵⁹ This reasoning is similar to guidance the Council on Environmental Quality (CEQ) issued in 1997 suggesting that the environmental impacts assessment process required of federal actions under the National Environmental Policy Act (NEPA) “provides an excellent mechanism for consideration of ideas related to global climate change.” Draft Memorandum from Kathleen A. McGinty to Heads of Federal Agencies Re: Guidance Regarding Consideration of Global Climatic Change in Environmental Documents Prepared Pursuant to the National Environmental Policy Act (Oct. 8, 1997). As CEQ explained:

The available scientific evidence...indicates that climate change is “reasonably foreseeable” impacts [sic] of emissions of greenhouse gases, as that phrase is understood in the context of NEPA and CEQ regulations...Specifically, federal agencies must determine whether and to what extent their actions affect greenhouse gases. Further, federal agencies must consider whether the actions they take, e.g., the planning and design of federal projects, may be affected by changes in the environment which might be caused by global climatic change.

Id. at 4. The CEQ has not issued further guidance or policy on the topic.

To be sure, as with the listing decision, the FWS consultation decision depends on a three-part causal chain: greenhouse gas emissions cause tropospheric warming, which in turn causes secondary climate change effects, which in turn cause ecological changes that adversely affect the species. Yet, although determining whether these downscale effects actually occur may be difficult to say in particular scenarios, the point is that they could occur. Unless the FWS intends on ruling out that possibility entirely—a difficult proposition after *Massachusetts v. EPA*—it stands to reason that consultations under section 7(a)(2) should consider the possible direct, indirect, and cumulative effects of greenhouse gas emissions and climate change.

Indeed, one recent judicial opinion makes it clear that the FWS *must* at least address climate change in jeopardy consultations. In *Natural Resources Defense Council v. Kempthorne*,¹⁶⁰ the FWS had prepared its consultation report, known as a biological opinion (BiOp), regarding the effects of the Central Valley Project-State Water Project (CVP-SWP) in California on a small fish, the Delta smelt. The BiOp's conclusions were based in part on the assumption that the hydrology of the water bodies affected by the project would follow historical patterns for the next 20 years, whereas a number of environmental groups had directed FWS's attention to several studies on the potential effects of climate change on water supply reliability, urging that the issue be considered in the BiOp. Reminiscent of EPA's position in *Massachusetts v. EPA*, the FWS attempted to defend not considering climate change at all:

Plaintiffs argue that, despite this evidence that climate change could seriously impact the smelt by changing Delta hydrology and temperature, the BiOp “did not so much as mention the probable effects of climate change on the delta smelt, its habitat, or the magnitude of impacts that could be expected from the 2004...operations, much less analyze those effects.” Defendants and Defendant-Intervenors respond by arguing (1) that the evidence before FWS at the time the BiOp was issued was inconclusive about the impacts of climate change; and (2) that, far from ignoring climate change, the issue is built into the BiOp's analysis through the use of [saline water condition data] as a proxy for the location and distribution of Delta smelt.¹⁶¹

But the court evidenced little tolerance for the agency's failure to address these issues in the consultation documents:

The climate change issue was not meaningfully discussed in the biological opinion, making it impossible to determine whether the information was rationally discounted because of its inconclusive nature, or arbitrarily ignored...

The BiOp does not gauge the potential effect of various climate change scenarios on Delta hydrology. Assuming, arguendo, a lawful adaptive management approach, there is no discussion when and how climate change impacts will be addressed, whether existing take limits will remain, and the probable impacts on CVP-SWP operations.

FWS acted arbitrarily and capriciously by failing to address the issue of climate change in the BiOp.¹⁶²

¹⁶⁰ 2007 WL 1577896 (E.D. Cal. May 25, 2007).

¹⁶¹ *Id.* at *38-39.

¹⁶² *Id.* at *40-41.

As did the majority in *Massachusetts v. EPA*, however, the *Kemphorne* court made it clear that at this stage of the litigation “there is no basis to determine what weight FWS should ultimately give the climate change issue in its analysis.”¹⁶³ The agency’s error, in other words, was in not addressing climate change *at all*. By contrast, once it has taken up the subject in a consultation, the agency may have considerable latitude in evaluating the indirect and cumulative effects of climate change, given that they must be “reasonably certain to occur” and must “reasonably...be expected” to jeopardize the species.

As with the section 9 take prohibition, however, the problem with fitting climate change into the consultation framework is that it exhibits more certainty at macro levels than at micro levels. Consider, for example, the proposed coal-fired power plant in Florida and its effects on the pika in the Sierra Nevada Mountains.¹⁶⁴ It would seem quite a stretch to conclude that the power plant emissions will jeopardize the pika, yet at a macro level the analysis is rather straight forward: the power plant emits greenhouse gases (a direct effect of the action), greenhouse gases are reasonably certain to warm the troposphere (an indirect effect of the action), a warming troposphere is reasonably certain to adversely alter ecological conditions for the pika, and it is reasonably expected that further such ecological changes will bring an end to the pika. At the micro level, however, it becomes difficult to link the plant’s emissions as the jeopardizing agent for the pika, given that *all* greenhouse gas emissions worldwide are subject to the same macro analysis. Other than quantity of emissions, the FWS would have no reasoned basis for distinguishing between the power plant in Florida, a farm in Kansas, or an elementary school in Oregon. All have an adverse effect on the pika, some arguably have more of an effect, but given the small proportion each represents of total greenhouse gas emissions, the FWS is likely easily to be able to justify finding none of the emitting land uses jeopardizes the species.

It is difficult to conceive of how the agency would go about trying more aggressively to regulate greenhouse gas emissions through the jeopardy consultation program. It does not have the pollution control expertise of EPA, nor does any provision of the ESA explicitly provide authority to engage in emissions regulation. The threat of jeopardy findings, which would have to be applied universally to all emission sources given all emissions present the warming effects, might induce emission sources to engage in emission offsets (e.g., by purchasing forestation credits) or technological and operational emission reductions, but is the agency equipped to assume the role of nation-wide regulator of farms, industrial facilities, auto emissions, and everything else? In short, the idea that *all* emission sources present jeopardy conditions to each and every climate-threatened species would prove too much, and likely render the ESA and the FWS political targets in the first degree.

On the other hand, the climate change issue in *Kemphorne* did not involve analysis of the indirect effects of a project’s greenhouse gas emissions, but rather focused on how the cumulative effects of climate change will influence the effects of a project on a protected species. The FWS had evaluated the effects of the project on the smelt assuming no change in hydrology

¹⁶³ *Id.* at *41 n.28.

¹⁶⁴ The considerable distance between the action and the species is not determinative. The FWS consultation regulations define “action area”—the geographic scope of the consultation analysis—as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” 50 C.F.R. §402.02. The analysis thus is not limited to the “footprint” of the action nor is it limited by the Federal agency’s authority. Rather, it is a biological determination of the reach of the proposed action on listed species. Subsequent analyses of the environmental baseline, effects of the action, and levels of incidental take are based upon the action area.

relevant to the smelt, whereas there was evidence that climate change could adversely affect hydrological conditions for the smelt in a way that could have altered the consultation effects analysis. The effect of *Kemphorne* is to require that where downscale modeling and field observations indicate it is “reasonably certain” that climate change will lead to changes in ecological conditions to the detriment of a protected species, the FWS *must* engage in a consultation to determine whether the project, taking those changes into account as cumulative effects, is “reasonably expected” to jeopardize the species. The FWS may in many cases point to the difficulty of downscaling climate change effects to support a no jeopardy finding,¹⁶⁵ but that does not absolve it of the duty to conduct the analysis.

Like the EPA under the Clean Air Act, therefore, the FWS has no room to dodge its mandate to consider the effects of climate change in consultations under section 7(a)(2) of the ESA. The fact that most consultations will not reach a jeopardy finding based on the indirect effects of the action’s greenhouse gas emissions or the cumulative effects of climate change is beside the point—most consultations already do not reach jeopardy findings.¹⁶⁶ Conducting the climate

¹⁶⁵ Many commentators have argued that the ESA inherently demands implementation under an implied background principle of affirmative conduct favoring conservation of protected species. The most prominent example is found in the 1995 report of the National Academy of Sciences’ National Research Council (NRC) in which NRC engaged in a top to bottom review of the role of science in ESA decision making and concluded, among other things, that the precautionary principle should be applied in ESA contexts so as to impose the burden of proving no harm on the proponent of an action. See NATIONAL RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT 169 (1995). Indeed, some passages of the legislative history of the jeopardy consultation provisions suggest that Congress believed the FWS and NMFS should, or at least could, “give the benefit of the doubt to the species” when information is not conclusive, as might often be the case with respect to climate change effects. See H.R. CONF. REP. NO. 96-697, at 159 (1979), *reprinted in* 1979 U.S.C.C.A.N. 2557, 2576. In these and other decision making settings where incomplete or inconclusive information requires the agency to make a close call, several courts have also endorsed the idea of giving the benefit of the doubt to the species. See *Conner v. Burford*, 848 F.2d 1441, 1451-54 (9th Cir. 1988) (FWS must “give the benefit of the doubt to the species” when FWS concluded that there was “insufficient information available to render a comprehensive biological opinion” concerning oil and gas leases); *Defenders of Wildlife v. Babbitt*, 958 F. Supp. 670 (D.D.C. 1997) (FWS must “give the benefit of the doubt to the species” and list the Canada Lynx despite the FWS’s claim that there was not “substantial information that the southern Rocky Mountain population of the Canada lynx meets the definition of a ‘species’”). Also, NMFS has on occasion announced in listing and jeopardy consultation decisions that it would provide that benefit of the doubt to the species or, in the same spirit, would “err on the side of the species.” See, e.g., 66 Fed. Reg. 29502 (May 31, 2001) (promulgating regulations under the ESA governing the approach of listed whales, in part to implement a precautionary principle approach); 56 Fed. Reg. 58619 (Nov. 20, 1991) (deciding to list a population of salmon notwithstanding uncertainty as to whether it was genetically distinct from other populations); NMFS, Section 7 Consultation Biological Opinion for Bering Sea/Aleutian Islands Groundfish Fisheries 133 (Oct. 19, 2001) (explaining that the agency conducted the consultation by at all times giving the “benefit of the doubt” to the species); NMFS, Section 7 Consultation Biological Opinion on Atlantic Highly Migratory Species Fishery Management Plan 99 (explaining that in selecting takes of turtles from specified activities the agency would “err on behalf of the species”); see also *Oregon Natural Resources Council v. Daley*, 6 F.Supp.2d 1139, 1149 (D. Or. 1998) (quoting an NMFS official’s rationale for recommending listing of a population of salmon as being the “err on the side of the species” principle). But it is clear that the statute *imposes* no such default rule, and the agencies have not officially adopted one as formal policy. Saying that FWS and NMFS *may* err on the side of the species in the face of inconclusive evidence, including in the case of climate change effects, does not mean that they *must*. See also the discussion of the “best scientific data available” standard *infra* Part IV.E.

¹⁶⁶ From 1998-2001, the FWS conducted over 300,000 consultations, the vast majority of which resulted in findings that the action would not adversely affect the species or that, if there was an effect, it would not jeopardize the species. See U.S. Fish & Wildlife Serv., Consultations with Federal Agencies: Section 7 of the Endangered Species Act 2 (Feb. 2002), *available at* <http://www.fws.gov/endangered/consultations/consultations.pdf>.

change analyses, however, will improve knowledge about the effects of climate change on species and thus is by no means a waste of agency resources.

D. Section 10: Incidental Take Permits and Experimental Populations

Section 10 of the ESA contains a hodge-podge of permitting programs and other exceptions to the proscriptions found elsewhere in the statute, primarily the section 9 take prohibition. Two such programs that are likely to be at the center of the agency's climate change policy are the incidental take permit program and the experimental populations program.

1. Adaptive Management Provisions of Incidental Take Permits

Section 10(a) of the ESA establishes an procedure under which the FWS may approve take of listed species otherwise prohibited under section 9 for actions that are incidental to otherwise lawful actions and not subject to the section 7 jeopardy consultation process.¹⁶⁷ The mechanism for evaluating actions for which such approval is sought is the habitat conservation plan, or HCP, through which the applicant describes the project and its impacts on the species.¹⁶⁸ To approve the permit, the agency must find that the HCP ensures that "the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking," and that "the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild."¹⁶⁹

Because the FWS's issuance of an HCP permit is a federal action within the meaning of the Section 7(a)(2) jeopardy consultation, the reasoning of the *Kemphorne* case outlined above in Part IV.C will carry over to the environmental assessment process for HCP permits. The HCP program contains the additional requirement that the applicant will "minimize and mitigate" the incidental take impacts "to the maximum extent practicable." If the FWS took the great leap of characterizing greenhouse gas emissions as causing take of climate-threatened species under section 9, the agency could assert that applicants must reduce or offset greenhouse gas emissions to satisfy this demand, using the "maximum extent practicable" standard to moderate what is expected. Even if greenhouse gases are kept off the table as a regulatory target, the "minimize and mitigate" requirement could limit overbearing effects of human adaptation to climate change for land uses requiring an HCP permit.

Another wrinkle of the HCP program arises under the so-called No Surprises policy for HCP permits, a controversial process under which a permittee is relieved of the need to address "unforeseen circumstances" but must agree to manage and respond to the effects of "changed circumstances" identified in the permit documents.¹⁷⁰ Under No Surprises, the FWS provides

¹⁶⁷ For a concise but comprehensive overview of the structure, history, and policy of the HCP program, see Robert D. Thornton, *Habitat Conservation Plans: Frayed Safety Nets or Creative Partnerships?*, 16 NATURAL RESOURCES & ENV'T 94 (Fall 2001). Actions that must track through the jeopardy consultation process can receive incidental take authorization in connection with the consultation pursuant to "reasonable and prudent measures [FWS] considers necessary and appropriate to minimize such impact." See 16 U.S.C. § 1533(b)(4).

¹⁶⁸ 16 U.S.C. 1539(a)(2)(A).

¹⁶⁹ 16 U.S.C. 1539(a)(2)(B)(ii) and (iv).

¹⁷⁰ See 63 Fed. Reg. 8859 (Feb. 23, 1998) (codified at 50 CFR §§ 17.22, 17.32, 222.2). The policy has been described as an essential component of the HCP program, necessary to make HCPs attractive to landowners. See Fred P. Bosselman, *The Statutory and Constitutional Mandate for a No Surprises Policy*, 24 ECOLOGY L.Q. 707 (1997). The No Surprises policy, then rule, has been the subject of intense procedural and substantive legal

participants in an approved HCP that is being properly implemented the assurance that the Service will not impose additional mitigation requirements in the event that unforeseen circumstances occur over time that negatively impact the species.¹⁷¹ Unforeseen circumstances means changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably have been anticipated by plan developers and the Service at the time of the plan's negotiation and development, and that result in a substantial and adverse change in the status of the covered species.¹⁷²

On the other hand, the No Surprises rule recognizes that some changes in circumstances affecting a species or geographic area covered by an HCP can reasonably be anticipated by plan developers and the Service and can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events).¹⁷³ To the extent such changed circumstances are provided for in the HCP's operating conservation program, the permittee must implement the appropriate measures in response to the changed circumstances.¹⁷⁴ Often these are detailed and the response measures discussed under the permit provisions dealing with "adaptive management."¹⁷⁵

challenges. *See, e.g.,* Spirit of the Sage Council v. Norton, 294 F. Supp. 2d 67 (D.D.C. 2003) (finding the rule was not procedurally void). Recently, however, the court presiding over the litigation found that all procedural defects had been corrected and deemed the rule substantive valid under the ESA. *See* Spirit of the Sage Council v. Kempthorne, No. 98-1873 (D.D.C.) (mem. op. of Aug. 30, 2007).

¹⁷¹ *See* 50 C.F.R. § 17.22(b)(5)(iii).

¹⁷² *See* 50 C.F.R. § 17.3.

¹⁷³ These are known as "changed circumstances." 50 C.F.R. § 17.3.

¹⁷⁴ *See* 50 C.F.R. § 17.22(b)(5)(i).

¹⁷⁵ Under adaptive management, regulators use models of natural resource systems to develop performance measurements and initial policy choices, but build into the regulatory implementation framework a process for continuous monitoring, evaluation, and adjustment of decisions and practices.

The concept of adaptive management promotes the notion that management policies should be flexible and should incorporate new information as it becomes available. New management actions should build upon the results of previous experiments in an iterative process. It stresses the continuous use of scientific information and monitoring to help organizations and policies change appropriately to achieve specific environmental and social objectives.

NATIONAL RESEARCH COUNCIL, THE MISSOURI RIVER ECOSYSTEM: EXPLORING THE PROSPECTS FOR RECOVERY 18-19 (2002). There is broad consensus today among resource managers and academics that adaptive management is the only practical way to implement ecosystem management policy. *See* Ronald D. Brunner and Tim W. Clark, *A Practice-Based Approach to Ecosystem Management*, 11 CONSERVATION BIOLOGY 48 (1997); Paul L. Ringold et al., *Adaptive Management Design for Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 745 (1996); Anne E. Heissenbuttel, *Ecosystem Management—Principles for Practical Application*, 6 ECOLOGICAL APPLICATIONS 730 (1996). Indeed, the Ecological Society of America's comprehensive study of ecosystem management treats the use of adaptive management methods as a given. *See* Norman L. Christensen, *The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 665 (1996). Appropriately, therefore, the FWS has announced it will administer HCP permits, where gaps in information can run high, using adaptive management as a means to "examine alternative strategies for meeting measurable biological goals and objectives through research and/or monitoring, and then, if necessary, to adjust future conservation management actions according to what is learned." *See* Notice of Availability of a Draft Addendum to the Final Handbook for Habitat Conservation Planning and Incidental Take Permitting Process, 64 Fed. Reg. 11485, 11486-87 (Mar. 9, 1999). HCPs thus are acknowledged to be working hypotheses of how species will respond to changes in habitat size, location, configuration, and quality. To truly integrate adaptive management into an HCP, the plan must include a monitoring program to evaluate the performance of mitigation measures and a system that automatically triggers alternative conservation actions in the event that performance fails to meet conservation goals. Gregory A. Thomas, *Incorporating Adaptive Management and the Precautionary Principle into HCP Design*, 18

The FWS has not directly addressed the issue of how climate change and greenhouse gas emissions play out under the unforeseen circumstances/changed circumstances dichotomy. In the preamble to the rule as adopted in 1998, however, FWS (with the NMFS) responded to comments raising the topic:

Issue 7: Many commenters stated that the applicant is legally required to address all unforeseen circumstances in the HCP pursuant to section 10. They noted that fire, disease, drought, flood, global climate change, and non-point source pollution may be unforeseen, but are not uncommon....In addition, commenters noted that the nature of many of the HCPs that the Services are approving increases the likelihood for unforeseen events to happen (i.e., the permits are issued for many years and cover large areas and many species).

Response 7: The Services disagree that HCPs must address all hypothetical future events, no matter how remote the probability that they may occur. Rather, the Services believe that only reasonably foreseeable changes in circumstances need to be addressed in an HCP. Moreover, these circumstances are likely to vary from HCP to HCP given the ever changing mix of species and affected habitats covered by a given plan....[U]nforeseen circumstances will only include events that could not reasonably have been anticipated. All reasonably foreseeable circumstances, including natural catastrophes that normally occur in the area, should be addressed in the HCP.¹⁷⁶

By incorporating a “reasonably foreseeable” standard, the FWS thus opened the door to the same kind of framework the *Kemphorne* court adopted for consultations under section 7(a)(2): the FWS *must* consider climate change when evaluating an HCP, and from there any reasonably foreseeable ecological effects should be taken into account under the changed circumstances category, not the unforeseen circumstances category. For long-term HCPs authorizing ongoing effects over decades, such as an industrial facility or regional development plan, a regime of adaptive management measures can be designed to integrate the capacity for the project to adjust operations and other parameters over time in response to the reasonably foreseeable climate change effects.¹⁷⁷ Even short-term projects, such as small subdivision developments, may rely on

ENDANGERED SPECIES UPDATE 32 (2001); George F. Wilhere, *Adaptive Management in Habitat Conservation Plans*, 16 CONSERVATION BIOLOGY 20 (2002). FWS thus has portrayed adaptive management as an important practical tool that “can assist the Services and the applicant in developing an adequate operating conservation program and improving its effectiveness.” See Notice of Availability of a Final Addendum to the Handbook for Habitat Conservation Planning and Incidental Take Permitting Process, 65 Fed. Reg. 35,242, 35,252 (June 1, 2000). For an in-depth discussions of the integration of adaptive management into the HCP program, see Holly Doremus, *Adaptive Management, the Endangered Species Act, and the Institutional Challenges of “New Age” Environmental Protection*, 41 WASHBURN L.J. 50, 68-74 (2001), and J.B. Ruhl, *Regulation by Adaptive Management—Is It Possible*, 7 MINN. J. LAW, SCIENCE & TECHNOLOGY 21 (2005).

¹⁷⁶ 63 Fed. Reg. at 8863.

¹⁷⁷ Some commentators posit that the No Surprises approach may constrain the use of adaptive management, as it cuts off revision of prior agreements about the HCP’s conservation measures. See Doremus, *supra* note __, at 72-73. On the other hand, one might just as reasonably complain that adaptive management undermines the No Surprises policy, as its very purposes is to ensure the ability to adjust decisions after the HCP is issued. In fact, however, the two approaches seem to me to be complementary, not conflicting. The No Surprises policy simply defines who is responsible for measures necessary to address unforeseen circumstances, and a comprehensive, criteria-specific adaptive management provision in an HCP negates the argument that matters contemplated as the subject of adaptive management were unforeseen for purposes of the No Surprises policy. It should be in the interests of the agency and the applicant, therefore, to negotiate an adaptive management provision that spells out its scope and subject matter with clarity and precision, including the reasonably foreseeable effects of climate change.

long-term mitigation measures, such as habitat preserves, which may be influenced by climate change and which therefore should integrate long-term adaptive management measures.

2. Assisted Migration through Experimental Populations

My earlier observation that pikas cannot fly away from the mountaintop predicament, but that we might fly them away, was not meant to be facetious. The emerging topic of assisted migration posits just that—move stranded species away from their degrading natural habitat to suitable habitat located beyond the species’s migratory capacity. Ironically, it may be the case that this suitable habitat is not “natural” to where it is located, but rather has been forming far outside the doomed species’s range because of climate change.

The agency appears to have the authority to engage in assisted migration. Section 10(j) of the ESA allows the FWS to transport and release members of an endangered or threatened species to areas outside its current range as an “experimental population,” if the agency “determines that such release will further the conservation of such species.”¹⁷⁸ The release must be to an area that contains suitable natural habitat within the “probable historic range” of the species, unless such habitat has been destroyed, in which case the release may be to areas not formerly occupied by the species.¹⁷⁹ A species which is losing habitat within its current and historic range because of climate change effects, but which at the same time is gaining habitat outside its historic range because of climate change, appears to fit these conditions, though there is no instance in which the FWS (or the NMFS) has exercised this option with respect to a species listed under the ESA because of threats resulting from climate change.

E. The Ubiquitous “Best Science” Standard

As an intersection between biological science and law, the reliability of decision making under the ESA necessarily depends on the quantity and quality of scientific information available to and used by the decision makers. The ESA could hardly operate on less than robust and reliable scientific data. But what is the agency supposed to do about defining, obtaining, and evaluating the universe of data about climate change and its effects in order to make its substantive decisions under the listing, take prohibition, consultation, and HCP programs? What is its decision-making method to be?

The ESA’s answer is the so-called “best scientific data available” standard, which permeates several of the statute’s major programs. For example, when deciding whether to list a species, FWS and NMFS must consider factors such as loss of habitat¹⁸⁰ using only “the best scientific and commercial data available.”¹⁸¹ Similarly, the biological component of the decision whether

¹⁷⁸ 16 U.S.C. § 1539(j)(2)(A). Authorization for agency or organization relocating the population is obtained under section 10(a)(1)(A) of the ESA, which provides for the FWS to grant permits “to enhance the propagation or survival of the affected species, including, but not limited to, acts necessary for the establishment and maintenance of experimental populations.” 16 U.S. C. § 1539(10)(a)(1)(A). The “but not limited to” language of this permitting provision suggests other potential applications may arise in connection with enhancing the survival of climate-threatened species.

¹⁷⁹ See 50 C.F.R. § 17.81(a).

¹⁸⁰ See 16 U.S.C. § 1533(a)(1)(A).

¹⁸¹ See 16 U.S.C. § 1533(b)(1)(A).

to designate critical habitat must use the “best scientific data available.”¹⁸² And the “no jeopardy” and “no adverse modification” directives to federal agencies adopt the same standard.¹⁸³

Although the ESA leaves this “best scientific data available” standard of evidentiary quality undefined,¹⁸⁴ in *Bennett v. Spear* a majority of the Supreme Court suggested that its “obvious purpose...is to ensure that the ESA not be implemented haphazardly, on the basis of speculation or surmise...[and] to avoid needless economic dislocation produced by agency officials zealously but unintelligently pursuing their environmental objectives.”¹⁸⁵ It can act, in other words, as a check on both the hasty application of regulatory power and the uninformed use of science. Accordingly, the courts have interpreted it to impose several practical guidelines on the agencies:¹⁸⁶

- The agencies may not manipulate their decisions by unreasonably relying on certain sources to the exclusion of others.
- The agencies may not disregard scientifically superior evidence.
- Relatively minor flaws in scientific data do not render that information unreliable.
- The agencies must use the best data available, not the best data possible.
- The agencies may not insist on conclusive data in order to make a decision.
- The agencies are not required to conduct independent research to improve the pool of available data.
- The agencies thus must rely on even inconclusive or uncertain information if that is the best available at the time of the decision.
- The agencies must manage and consider the data in a transparent administrative process

Similarly, in 1994 FWS and NMFS issued a joint policy providing guidelines for how the agencies will ensure their ESA decisions incorporate this evidentiary standard.¹⁸⁷ The policy directs the agencies to follow six guidelines in ESA implementation decisions including species listing, jeopardy consultations, and incidental take authorizations:

- Require that all biologists evaluate all scientific and other information that will be used to make the decision.

¹⁸² See 16 U.S.C. § 1533(b)(2)

¹⁸³ See 16 U.S.C. § 1536(c); 50 C.F.R. 402.14(g)(8).

¹⁸⁴ Although several other environmental statutes use the phrase or something close to it, all leave it undefined. See Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn't Always Better Policy*, 75 WASH. U. L.Q. 1029, 1034 n.9 (1997) (collecting statutes); Michael J. Brennan et al., *Square Pegs and Round Holes: Application of the “Best Scientific Data Available” Standard in the Endangered Species Act*, 16 TUL. ENVTL. L.J. 387, 402 n.81 (2003) (collecting statutes).

¹⁸⁵ 520 U.S. 154, 169 (1997).

¹⁸⁶ See *Southwest Center for Biological Diversity v. Norton*, 2002 WL 1733618, at *8 (D.D.C. 2002) (summarizing the existing body of case law); see generally Brennan et al., *supra* note __, at 396-430; Doremus, *supra* note __, at 1051-85; John Earl Duke, *Giving Species the Benefit of the Doubt*, 83 B.U. L. REV. 209 (2003); Laurence Michael Bogert, *That's My Story and I'm Sticking To it: Is the “Best Available” Science Any Available Science Under the Endangered Species Act?*, 31 IDAHO L. REV. 85 (1994).

¹⁸⁷ 59 Fed. Reg. 34,271 (July 1, 1994).

- Gather and impartially evaluate biological, ecological, and other information that disputes official positions, decisions, and actions proposed or taken by the FWS or NMFS.
- Ensure that biologists document their evaluation of information that supports or does not support a position being proposed by the agency.
- Use primary and original sources of information as the basis for consultation decisions or recommendations.
- Adhere to the timeframes or “schedules” established by the ESA.
- Conduct management-level review of documents developed by the agency to verify and assure the quality of the science used to established official positions.

All that sounds impressive, but the question arises whether appending “best,” “scientific,” and “available” to the general standard that agencies base their decisions on evidence in the record has made any appreciable difference in the substantive discretion the agency enjoys.¹⁸⁸ After all, the default rules for those statutes are provided in the conventional judicial review provisions of the Administrative Procedure Act (APA), under which any court would routinely find that an agency’s reliance on sloppy, biased, or haphazard evidence is arbitrary and capricious.¹⁸⁹ It is difficult to pinpoint the incremental legal effect, if any, the “best scientific data available” standard adds to that baseline. On the one hand, the courts behave as if the standard means *something*,¹⁹⁰ yet it is not clear that any of the decisions finding the standard to have been satisfied or violated would have turned out different under the conventional APA judicial review tests. It is not possible to extract from case law, administrative policy, or legislative intent any independent mandate of agency decision making method or standard of

¹⁸⁸ I have examined this question in more detail elsewhere. See J.B. Ruhl, *Is the Endangered Species Act Ecopragmatic?*, 87 MINN. L. REV. 885, 927-29 (2003); Ruhl, *Methodology*, *supra* note __, at 579-84.

¹⁸⁹ The conventional rules of judicial review—the default rules when the agency’s organic act is silent—are found in the Administrative Procedure Act (APA). 5 U.S.C. § 706. These rules require the courts to apply considerable deference to the agency’s decision. A reviewing court may not substitute its judgment for the agency, but must undertake a “thorough, probing, in-depth review” of the agency’s decision. *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402, 415-16 (1971). Thus, a court will reject an agency’s decision if it is “arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.” 5 U.S.C. § 706(2)(A); see, e.g., *Biodiversity Legal Foundation v. Babbitt*, 146 F.3d 1249, 1252 (10th Cir. 1998). An agency decision is arbitrary and capricious if the agency either “has relied on factors which Congress had not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise,” or if it has failed to “articulate a satisfactory explanation for its action including a ‘rational connection between the facts found and the choice made.’” *Motor Vehicles Mfrs. Ass’n v. State Farm Mutual Auto Ins. Co.*, 463 U.S. 29, 43 (1983) The ESA has been widely interpreted as being subject to these rules with no substantial exceptions. See, e.g., *American Wildlands v. Norton*, 193 F.Supp.2d 244, 251 (D.D.C. 2002); *Loggerhead Turtle v. County Council of Volusia County*, 120 F.Supp.2d 1005, 1013 (M.D. Fla. 2000); *Friends of the Wild Swan, Inc. v. United States Fish & Wildlife Serv.*, 945 F. Supp. 1388 (D. Or. 1996).

¹⁹⁰ See, e.g., *Southwest Center for Biological Diversity v. Norton*, *supra*.

judicial review the provision adds to the picture.¹⁹¹ Nor does commentary on the standard suggest that it imposes higher duties.¹⁹²

On the other hand, if it does establish anything, the standard acknowledges that the FWS is the expert science agency when it comes to defining threats to species and the measures needed for conservation of species.¹⁹³ Hence, while the FWS is not the nation's expert science agency on the physical causes and consequences of climate change, it should be responsible for being the repository of knowledge and research on the biological effects of climate change on species. Whether it is through the "best available scientific evidence" standard or through plain vanilla APA judicial deference, if the agency lives up to that responsibility, its exercise of discretion within the bounds detailed above should be respected.

The "best scientific data available" standard thus turns out to be quite flexible with respect to how the FWS can employ it to carry out a passive or aggressive climate change policy. To be sure, after *Massachusetts v. EPA*, the FWS, like any other regulatory agency, would be hard-pressed to hide behind "scientific uncertainty" to take the position that species are not in general threatened by climate change and thus the ESA triggers no agency responsibilities. Indeed, the *Kemphorne* court rejected that position in no uncertain terms. In its effort to force the FWS to consider the effects of climate change in the biological opinion covering the Central Valley Project, the plaintiff environmental group had argued that "[r]egardless of the uncertainty involved in predicting the consequences of climate change, FWS had an obligation under the ESA to address the probable effects on Delta smelt," to which the defendant water contractors responded that *Bennett v. Spear* "intended to preclude exactly this kind of argument."¹⁹⁴ The court rebuffed that interpretation of *Bennett*, explaining that Court held only "that persons who are economically burdened by a decision made under the ESA fall within the zone of interests the statute protects for the purposes of standing. *Bennett* sheds little light on the current inquiry—whether and to what extent the data that was before the FWS regarding climate change should have been considered and addressed in the [biological opinion]."

Yet, assuming the agency must peer into the climate change blender, the difficulties associated with downscaling global and regional models of climate change impacts to specific species and their local ecological contexts provide the agency substantial leeway as to what it sees, for on this score the FWS is *the* expert agency. Provided the agency acts within its statutory bounds by considering climate change where it must or may, engages the available downscaling science, and assesses its application to a particular species with the air of its expert position evident in the record, courts will be hard-pressed to look behind the agency's conclusion one way or the other regarding the level of threat climate change poses to a species, the areas appropriate for designation of critical habitat for a species threatened or endangered by climate

¹⁹¹ For example, courts have been reluctant to uphold challenges to the substance of FWS jeopardy opinions based on allegations that the best available science standard adds some special kick to the default rules of the APA. See Katherine Renshaw, *Leaving the Fox to Guard the Henhouse: Bringing Accountability to Consultation Under the Endangered Species Act*, 32 COLUM. J. ENVTL. L. 161 (2007).

¹⁹² See, e.g., LIEBESMAN AND PETERSEN, *supra* note __, at 16 (discussing the standard in the context of the basic APA judicial review criteria); Brennan et al., *supra* note __, at 412-32 (thorough review of cases interpreting the "best scientific data available" standard).

¹⁹³ See, e.g., *Loggerhead Turtle v. County Council of Volusia County*, 120 F.Supp.2d 1005, 1023 (M.D. Fla. 2000) ("where there is a substantial volume of research, data, and comments, the agency exercises its expertise to make a reasonable decision based on all the data and information").

¹⁹⁴ *Natural Resources Defense Council v. Kemphorne*, 2007 WL 1577896, *40 n.27 (E.D. Cal. May 25, 2007).

change, or the effects of a proposed land use on such a species. Of course, as the downscaling science becomes “better” and more “available,” the agency will be more constrained in this regard, having to acknowledge greater or less uncertainty where it plainly exists, but environmental or industry groups will have to establish that in the courts case by case. Overall, therefore, the “best scientific data available” standard appears to provide the FWS a background source of discretion that may, for the foreseeable future, be quite substantial in scope and useful to the agency in shaping policy choices under each of the ESA’s primary programs.

V. USING THE ESA TO CARRY SPECIES TO THE NO-ANALOG FUTURE

The task ahead of the FWS is daunting, and it must use the discretion outlined in Part IV to develop a plan soon lest its mission be swept away by climate change along with its charges. As Part II explained, manifestations of climate change already are well underway and already have had adverse impacts on some species. More can be expected. Indeed, the FWS must assume that more climate change impacts will unfold even if the global community takes measures to mitigate greenhouse gas emissions. As Part III demonstrated, this assumption poses complex policy questions for the FWS, though Part IV showed that the agency has considerable flexibility in how it answers them. It has the discretion, within bounds, to adopt passive or aggressive policies for how to integrate climate change in ESA programs.

With that foundation established, therefore, what should define the agency’s set of operating assumptions about how the global community responds generally to climate change—pessimism or optimism? A worst case scenario would have the global community fail utterly to contain greenhouse gas emissions and, as a result, climate change spirals into chaos for centuries. In that scenario the FWS might as well pack up its bags and close shop, as climate change will dominate as an unassailable force in ecological reshuffling that overwhelms any management of ecosystems or species. Exercising the ESA, in other words, is pointless in this scenario.

On the other hand, the agency also cannot afford to assume a Pollyanna future in which the global community comes together tomorrow, drastically reduces emissions, and somehow sucks carbon dioxide out of the troposphere to 1990 levels by the end of this decade. The message of *Massachusetts v. EPA* is that a regulatory agency can’t assume someone else will address the climate change problem and its regulatory program is not part of the solution. Each agency must “whittle away” with whatever knife Congress has provided it.

The ESA will be best served, therefore, if the FWS adopts a cautious optimism that recognizes the limits of the ESA but keeps it relevant. Conceding that some human-induced climate change is inevitable even in the best of circumstances does not concede that it will be perpetual and chaotic. Rather, the FWS can reasonably assume that the global community will eventually arrest greenhouse gas emissions to a benchmark level and that, as a consequence, climate regimes will eventually settle into a new “natural” pattern of variation.¹⁹⁵ We have no analog for what that pattern will be, and the transition from the present to that future will be, by all appearances, a rocky ride, but in all probability we will get there. The job of the ESA is to help as many species as is reasonably possible get there with us—to serve as their bridge across the climate change transition into the no-analog future.

¹⁹⁵ There is strong evidence that almost every flow system in nature, from Earth’s jet streams to Jupiter’s banded winds, responds to disturbances by moving toward self-organized order. See Richard A. Kerr, *Order from Chaos, Power From Dissipation in Planetary Flows*, 317 SCIENCE 449 (2007).

Ironically, to do this will take some humility and restraint. Going for the jugular by regulating greenhouse gas emissions is *not* where the ESA can be of most help to imperiled species. There is little to be gained for the FWS or for climate-threatened species by having the agency go down this road. The agency has no explicit authority to do so, does not have the expertise to do so, and would risk undermining the political viability of the ESA by doing so. Rather, the FWS can provide expert assistance to agencies that are more appropriately charged with regulating greenhouse gas emissions, such as the EPA, by advising them about the effects of climate change on species.¹⁹⁶

As for its direct role in addressing climate change, the FWS can employ the ESA most effectively by identifying species threatened by climate change, identifying which of those can be helped through the ESA's habitat-based programs, and devising a management plan—one that uses regulatory action as well as recovery planning—to build each such species its bridge. Indeed, this strategy allows the FWS the luxury of dispensing with the need to distinguish between human-induced and natural climate variation. Climate change is climate change—it does not matter to species what is causing it. What does matter to them is whether and how sustainably they survive through it.

This brings us to the five policy pressure points raised in Part III. To implement the proposed bridge policy, I suggest the FWS approach the policy choices as follows:

Identifying Climate-Threatened Species. The agency's objective should be to use the ESA to define and monitor the ecological reshuffling effects of climate change. The agency should aggressively identify species threatened by climate change. Early identification of species threatened by climate change and of the critical habitat they require for survival through climate change transition will help in defining the extent of ecological reshuffling and guide human adaptation programs. Early identification also will provide the basis for listing species as threatened, which provides more flexibility in terms of regulatory effects and recovery efforts.

Regulating Greenhouse Gas Emissions. The agency's objective should be to not squander agency resources in a futile effort for which the ESA is simply not equipped. The FWS should not attempt to use its section 7 and section 9 regulatory programs in an effort to regulate greenhouse gas emissions. As for the take prohibition, listing species early as threatened will allow the agency to remove greenhouse gas emissions from consideration under section 9 while keeping the take prohibition active with respect to other contributing threats. If an animal species is in endangered status, meaning section 9 necessarily applies in full force, difficulties in establishing the burden of proof would support the exercise of prosecutorial discretion not to attempt to regulate greenhouse gas emissions. Under the section 7 consultation program, project-specific jeopardy analyses should promote other federal agencies to consider ways of reducing greenhouse gas emissions, but should not lead to jeopardy findings.

Regulating Non-Climate Effects to Protect Climate-Threatened Species. The agency's objective should be to support the bridge function of the ESA and reduce the adverse impacts on species from human adaptation to climate change. Where a species weakened by climate change is also threatened by other anthropogenic sources, such as loss of habitat, and where the agency reasonably believes addressing the non-climate threats will help carry the species through the

¹⁹⁶ For example, federal agencies required to prepare environmental impact statement under the National Environmental Policy Act in connection with projects they carry out, fund, or authorize must "obtain the comments of any Federal agency which has...special expertise with respect to any environmental impact involved." 50 C.F.R. § 1503.1(a)(1).

climate change transition, the agency should use section 7 and section 9 regulatory powers to the extent necessary. In particular, where human adaptation to climate change exacerbates threats to a species, the agency should aggressively employ its regulatory presence through section 7 consultations and enforcement of the section 9 take prohibition. The agency also must monitor the impacts of human adaptation on species that face no direct or secondary ecological threat from climate change and employ section 7 and section 9 powers accordingly. Clearly, however, innovative approaches will be needed, such as market-based incentives and regional planning efforts, to facilitate human adaptation measures as much as species can tolerate.

Designing Conservation and Recovery Initiatives. The agency's objective should be to get as many species as is realistically possible through the transition to the other side of climate change with hope of survival and recovery in the much longer term. The agency must initially differentiate between species that are unlikely to survive climate change under any circumstances and those that are likely to benefit from assistance in their home ecosystems. Agency resources should not be wasted in developing recovery plans or other conservation measures for non-recoverable species. For species that appear likely to withstand climate change under the ESA's protection, recovery plans should identify the expected intensity of assistance required to manage or respond to primary and secondary ecological effects. Conservation measures for species that require intensive assistance, particularly in section 10 HCPs, should be designed around adaptive management techniques that involve ample monitoring and considerable room for adjustment of management actions in order to account for the possibility that continuing climate change will alter the effectiveness of those actions.

Species Trade-Offs. The agency's objective should be to not contribute to ecological reshuffling through its species management efforts. Where the measures described above are complicated by species trade-offs—when helping one may harm another—the agency should adopt an ecosystem-based management approach modeled on promoting long-term species diversity and ecosystem multi-functionality.¹⁹⁷ When ecological models do not point to a particular management action to serve those goals, general default priorities, such as assisting top-level predators and resisting induced invasions, may help mediate between species in conflict.

Dealing with the Doomed. The agency's objective should be to avoid accelerating the decline of species who stand no chance of surviving climate change, but not to take measures on their behalf which could pose threats to other species. Under this standard, assisted migration should be employed for a such a species only if the FWS has assembled conclusive evidence of the extinction threat, a quantitative model showing the likely success of assisted migration for the species with de minimis anticipated effects on other species, and an assisted migration management plan including long term monitoring and active adaptive management.¹⁹⁸ Human adaptation measures that could accelerate the extinction of the species, which could cascade to

¹⁹⁷ Maximizing biodiversity will assist the ecosystems of the future, whatever pattern they assume, in establishing and maintaining resilience. See Andy Hector and Robert Bagchi, *Biodiversity and Ecosystem Multifunctionality*, 448 NATURE 188 (2007).

¹⁹⁸ This approach is what McLachlen et al. refer to as “constrained assisted migration,” as opposed to aggressive use of assisted migration at one extreme and total prohibition of the practice at the other extreme. See Jason S. McLachlin et al., *A Framework for Debate of Assisted Migration in an Era of Climate Change*, 21 CONSERVATION BIOLOGY 297 (2006).

effect other species, should be regulated under section 7 and section 9 as for any other listed species.

VI. CONCLUSION

The “pit-bull” has met its match, but sometimes old dogs can learn new tricks. It is sobering to find that ecological reshuffling is inevitable and to realize that the ESA can’t do anything about it. Yet this is precisely what leads me to my proposal that the statute be employed in a more focused manner in the decades leading to our no-analog future. What the statute has done best is stop the decline of imperiled species brought under its protective wings, and it has done so in the face of problems as intractable as urbanization and invasive species. The ESA has not solved urban sprawl or invasive species—it has helped species deal with them. Likewise, we must find a way for the ESA to help species deal with the effects of climate change, not its causes. The statute provides this flexibility—the means to proactively identify the threat of climate change and focus on helping those species that can be helped.

My proposal is unlikely to satisfy strong supporters of the ESA or its strong critics. The former are likely to believe the “pit bull” has found its ultimate calling in climate change. If there is any statute that can wrestle greenhouse gas emissions to the ground (i.e., to 1990 levels), they might think, it is the ESA and its unrelenting biocentric mission, whereas my proposal keeps the statute at bay. The latter will object to my proposal’s aggressive call for species listings, which is based on wholesale adoption of the premise of human-induced climate change, and to its continued use of the statute as a regulatory weapon against habitat loss and other non-climate threats to climate-threatened species.

Both views doom the ESA. Of course, that may be the intent and hope of the statute’s critics, with or without climate change. But adopting the strong version of the ESA in the climate change era, in which the FWS charges hard after greenhouse gas emissions, would play right into the critics’ hands—the statute is neither designed to regulate something so ubiquitous as greenhouse gas emissions nor so sacrosanct as to survive the political battle attempting to do so would ignite. Support for the ESA, therefore, must be tempered by practical and political reality if the ESA itself is to survive climate change. The trade-off I propose—standing back from greenhouse gas emissions but staying fully engaged in regulating non-climate threats, particularly those stemming from human adaptation to climate change—is the plan the ESA needs in order to build the bridge for species into the no-analog future.