BETWEEN A ROCK AND A HARDENED PLACE: PRIORITIZING CLIMATE RESILIENCY FOR VULNERABLE BIODIVERSITY

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INTRODUCTION

Climate change is affecting where plants and animals can live, leaving our nation's most imperiled biodiversity in harm's way – caught between a rock and a hardened place.[1] More than fifteen percent of species listed under the Endangered Species Act ("ESA") are threatened by sea level rise, and inland species are at risk of being displaced as people retreat from rising seas and dangerous storms.[2] In some instances, adaptation policies to address climate change may be harming biodiversity.[3] The ESA, and assisted migration in particular, may help protect biodiversity from the climate crisis. However, assisted migration is not without its own perils.

After fifty years of the ESA, and with over 1,000 species listed, the federal wildlife agencies charged with implementing and enforcing the Act still struggle to meet the Act's basic task of protecting species.[4] The

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1. A play on the idiom "trapped between a rock and a hard place" – a hardened place, meaning the built infrastructure hardened to combat the impacts of climate change – to reflect one caught between two hard choices, or left without a real choice.

2. Center for Biological Diversity, *Deadly Waters: How Rising Seas Threaten 233 Endangered Species* 1 (2013) (finding "that 17 percent — one in six — of the nation's threatened and endangered species are at risk from rising sea levels"); Joe Minus, *The Displacement Trap: Knock-on Effects of Climate Induced Displacement*, CAMBRIDGE CORE BLOG (May 6, 2021), https://www.cambridge.org/core/blog/2021/05/06/the-displacement-trap-knock-on-effects-of-climate-induced-displacement/ (discussing the environmental and conservation consequences that result from human migration induced by climate change).

3. Callum M. Roberts et al, *Climate Change Mitigation and Nature Conservation Both Require Higher Protected Area Targets*, 375 PHIL. TRANSACTIONS ROYAL SOC'Y B, at 2 (discussing the "risk that if conservation and climate change mitigation agendas are misaligned, one could easily undermine the other").

4. 50 C.F.R. § 17.11(h) (providing a table of species listed as endangered or threatened

agencies,[5] for a number of reasons,[6] often require litigation or at least a threat of litigation to list species, designate their critical habitat, implement their recovery plans, and consult to ensure other federal agencies are not the reason the species blink out of existence.

And now, with more than half of the people and nearly half of the imperiled plants and animals in the United States living in coastal counties,[7] rising sea levels will confront these communities with unprecedented challenges. Coastal communities' ability to cope with the impacts of climate change will depend on how well adaptation and resiliency laws and policies protect them from rising seas, flooding, increased heat indices, and intensifying storm activity. At the same time, it is possible these very same adaptation laws and policies may cause unintended harm to biodiversity.

Looking at Florida's biodiversity, this essay supports a presentation made at the Duke Environmental Law and Policy Forum Symposium, *50 Years of the Endangered Species Act*. The essay examines how climate change threatens vulnerable biodiversity and how laws and policies regarding climate change mitigation, adaptation, and resiliency may impact different species. On this 50th anniversary of the ESA, this essay explores how the Act functions to protect endangered species in Florida and probes whether these measures adequately prioritize the protection of biodiversity in light of climate change.

CLIMATE CHANGE IS CHANGING WHERE BIODIVERSITY CAN THRIVE

Climate change will completely rewrite the experience of living in

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under the Endangered Species Act).

5. The U.S. Fish and Wildlife Service is responsible mainly for terrestrial and freshwater species, while the National Marine Fisheries Service is responsible for most marine species. *See About Us*, U.S. FISH & WILDLIFE SERV. https://www.fws.gov/program/endangered-species/about-us#:~:text=The%20U.S.%20Fish%20and%20Wildlife,anadromous%20fish%20such%20as%20salmon (last visited Apr. 6, 2024).

6. Reasons include the sheer number of species imperiled with extinction, political interference, and lack of adequate funding. Erich K. Eberhard et. al, *Too Few, Too Late: U.S. Endangered Species Act Undermined by Inaction and Inadequate Funding*, PLoS ONE 17(10): e0275322. http://doi.org/10.1371/journal.pone.0275322.

7. NOAA, STATE OF THE COAST: NATIONAL COASTAL POPULATION REPORT 3 (2013) (presenting research that shows 52% of the U.S. population lives in coastal watershed counties); S.2194, 117th Cong. § 2(a)(3) (stating that coastal areas support over 40% of the threatened species or endangered species, including 75% of the mammals and birds, listed under the Endangered Species Act).

Florida. Indeed, it already has. It is hotter.[8] Seas are higher.[9] There is more flooding.[10] There are fewer plants and animals.[11] And things will get worse for people and biodiversity.

The majority of people in Florida live in coastal counties, and about half a million people in Florida live on land that is less than three feet above the high water mark, putting more than $145 billion in property at imminent risk of flood damage.[12] Making matters worse, Florida's population is projected to grow by more than twenty percent in the next fifteen years, from 21.5 million to 26.4 million residents, and sea level is predicted to rise an additional ten inches.[13] This would result in the loss of one million acres of land and force the relocation of 205,000 Florida residents.[14] And this is just in the next fifteen years.

Florida is suffering from myriad climate impacts, including sea level rise, storms, flooding, and heat. Most of Florida is at or near sea level, has little topographic gradient, and has terrestrial and aquatic ecosystems that are highly sensitive to changes.[15] Climate change is a major threat to the persistence and functioning of Florida's natural coastal ecosystems. In Key West, Florida, the average sea-level rise was 8.8 inches over the past century, which is more than thirty percent higher than global averages.[16] The Southeast Florida Regional Climate Change Compact's "Unified Sea Level Rise Projection" for South Florida suggests future sea-level rise in excess of the expected global average: ten to twenty-one inches by 2040; twenty-one to forty inches by 2070; and forty to 136 inches by 2120.[17]

As Atlantic hurricanes and hurricane-generated storm surges are

8. U.S. EPA, *What Climate Change Means for Florida* (Aug. 2016), https://www.epa.gov/sites/default/files/2016-08/documents/climate-change-fl.pdf (showing average temperatures have risen in Florida by one to two degrees over the last century).

9. *Id.* (noting that sea levels along Florida's coasts are likely to rise one to four feet in the next century).

10. *Id.* (discussing the increasing risk of storm surges and heavy rainfall on flooding).

11. *Id.* (discussing the rising threats to plant and animal life due to climate change).

12. DANIEL RAIMI ET AL., FLORIDA CLIMATE OUTLOOK: ASSESSING PHYSICAL AND ECONOMIC IMPACTS THROUGH 2040 13 (Resources for the Future 2023).

13. 1,000 FRIENDS OF FLA. & UNIV. OF FLA. CTR. FOR LANDSCAPE CONSERVATION PLANNING, FLORIDA'S RISING SEAS: MAPPING OUR FUTURE, SEA LEVEL 2040 (2023).

14. *Id.*

15. THE FLA. CLIMATE CTR. & FLA. STATE UNIV. SEA LEVEL RISE AND COASTAL RISK 1 (2023).

16. NAT'L RSCH. COUNCIL OF THE NAT'L ACADS., PROGRESS TOWARD RESTORING THE EVERGLADES: THE FIFTH BIENNIAL REVIEW: 2014 131–33 (2014).

17. SE. FLA. REG'L CLIMATE CHANGE COMPACT SEA LEVEL RISE WORK GRP., 2019 UNIFIED SEA LEVEL RISE PROJECTION FOR SOUTHEAST FLORIDA 10, Figure 1 (2019).

increasing in intensity, coastal flooding in Florida is becoming more damaging.[18] The increasing frequency of extreme precipitation events is increasing coastal flooding risks, which are further compounded when storm surge and heavy rainfall occur together.[19] In recent years, hurricanes have cost Florida and the United States billions, with 2017's Hurricane Irma costing $50 billion[20] and 2022's Hurricane Ian costing more than $115 billion.[21] These storms have also had a direct human impact, respectively causing seventy-seven and 150 deaths in Florida.[22]

In addition to stochastic storms, regularly occurring nuisance flooding due to sea level rise has already resulted in severe property damage and social disruption.[23] The frequency and extent of tidal flooding are expected to continue to increase.[24] Storm surge and tidal flooding will occur on an increasingly higher sea surface and push water further inland.[25] Low-wealth populations and communities of color are the most vulnerable to financial loss associated with flooding.[26] This chronic flooding has the potential to impact states' abilities to fund their governments; for example, by 2045, properties representing forty percent or more of Florida's tax base will experience chronic flooding.[27]

And things are getting hotter. The Intergovernmental Panel on Climate Change, the most highly-regarded source for the most current

18. K. Hayhoe et al., *Our Changing Climate, in* IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NAT'L CLIMATE ASSESSMENT VOL. II 72–144 (D.R. Reidmiller et al. eds., 2018).

19. T. Wahl et al., *Increasing Risk of Compound Flooding From Storm Surge and Rainfall for Major U.S. Cities*, NATURE CLIMATE CHANGE 5 1093–98 (2015).

20. *Costliest U.S. Tropical Cyclones Tables Updated*, NOAA NAT'L HURRICANE CTR. (2023), https://www.nhc.noaa.gov/news/UpdatedCostliest.pdf.

21. *U.S. Billion-Dollar Weather and Climate Disasters,* NOAA NAT'L CTRS FOR ENV'T INFOR., https://www.ncei.noaa.gov/access/billions/ (last visited Feb. 22, 2024).

22. NOAA NAT'L HURRICANE CTR., HURRICANE IRMA (AL112017): 30 AUGUST–12 SEPTEMBER (2021).

23. *See* Shimon Wdowinski et al., *Increasing Flood Hazard in Coastal Communities Due to Rising Sea Level: Case Study of Miami Beach, Florida*, OCEAN & COASTAL MGMT. 126 (2016) (stating that "tide-induced floods have affected mostly low-lying neighborhoods . . . [and] have caused severe property damage and significant disruptions to daily life").

24. K. Hayhoe et al., *Our Changing Climate*, *in* IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NAT'L CLIMATE ASSESSMENT VOL. II (D.R. Reidmiller et al. eds., 2018).

25. C. Tebaldi et al., *Modelling Sea Level Rise Impacts on Storm Surges Along U.S. Coasts,* 7 ENV'T RES. LETTER 7, at 1 (2021).

26. NAT'L ACAD. OF SCI., ENG'G, & MED., FRAMING THE CHALLENGE OF URBAN FLOODING IN THE UNITED STATES 3 (2019), https://www.ncbi.nlm.nih.gov/books/NBK541180/.

27. Union of Concerned Scientists, *Underwater: Rising Seas, Chronic Floods, and the Implications for U.S. Coastal Real Estate* 7 (2018), https://www.ucsusa.org/sites/default/files/attach/2018/06/underwater-analysis-full-report.pdf.

and accurate climate data, recently reported that global temperatures could increase by 5.4–10.26 degrees Fahrenheit by the end of this century.[28] Experts predict sustained extreme heat for most parts of Florida in the coming years.[29] Florida, a warm place under normal conditions, has already experienced a 2-degree Fahrenheit increase in temperatures since the beginning of the twentieth century.[30] Mild by comparison to other states in the Southeast,[31] Florida is expected to experience the largest heat index escalation in the nation of 8– 15 degrees Fahrenheit by 2050.[32] This increase in temperature will result in the loss of moisture, worsening drought when precipitation – which varies widely – is low.[33]

These climate impacts are devastating Florida's biodiversity. The Fourth National Climate Assessment found that "climate change continues to impact species and populations in significant and observable ways . . . altering individual characteristics, the timing of biological events, and their geographic ranges. Local and global extinctions may occur when "climate change outpaces the capacity of species to adapt."[34] The Florida grasshopper sparrow, Miami blue butterfly, and the Florida key deer are just a few of the many Floridian species that are "highly likely to be extinct" at the end of the century

28. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2021 THE PHYSICAL SCIENCE BASIS SUMMARY FOR POLICYMAKERS 14 (2021). Table SPM.1 lists the "very likely range" of global surface increase in temperature for 2100 in Celsius as 3.5 to 5.7. To calculate Fahrenheit, multiply 1.8. Celsius to Fahrenheit Converter (°C to °F) (inchcalculator.com), https://www.inchcalculator.com/convert/celsius-to-fahrenheit/#:~:.

29. For example, Sarasota County is predicted to have seventy-nine days above a 100 heat index in 2023, and 112 by 2053. Ben Montgomery, *Mapping What Florida's Heat Will Look Like in 30 Years*, AXIOS (Aug. 16, 2022), https://www.axios.com/local/tampa-bay/2022/08/16/florida-extreme-heat-projections.

30. NOAA NAT'L CTRS. FOR ENV'T. INFO., STATE CLIMATE SUMMARIES: FLORIDA 2 (2022).

31. Florida actually has the fewest days above 100 degrees in the region.

32. NOAA NAT'L CTRS. FOR ENV'T. INFO., STATE CLIMATE SUMMARIES: FLORIDA 2 (2022).

Heat index refers to the human-perceived temperature by combining humidity and temperature. *Heat Forecast Tools*, NATL. WEATHER SERV., https://www.weather.gov/safety/heat-index (last visited Apr. 7, 2024).

33. NOAA NAT'L CTRS. FOR ENV'T. INFO., STATE CLIMATE SUMMARIES: FLORIDA 2 (2022).

34. The U.S. Global Change Research Program (USGCRP) published the Fifth National Climate Assessment shortly after Duke's symposium. D. Lipton et al, 2018 *Ecosystems, Ecosystem Services, and Biodiversity in Risks, and Adaptation.* in IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 289.

due to climate change.[35]

Nearly half of the listed species in the United States make their homes along the coasts.[36] Significant losses for coastal species and ecosystems are predicted, not just from the direct effects of climate change, but also from human response to it.[37] With rising seas, coastal plants and animals will become trapped between rising seas and human responses to the climate crisis.[38] At-risk plants and animals are especially susceptible because of their relatively low numbers, particular habitat needs, and other unmitigated threats.[39]

THE ENDANGERED SPECIES ACT CAN PROVIDE SIGNIFICANT RELIEF

It has been fifty years since Congress pronounced that endangered and threatened plants and animals are of "esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."[40] Congress announced that the purpose of the Endangered Species Act is to "provide a program for the conservation" of such species, to prevent extinction, and to recover their populations so the protections of the statute are no longer needed.[41]

The protective measures of the ESA, like listing, critical habitat, recovery plans, status reviews, and consultation, can contribute

35. Joshua Reece et al., *A Vulnerability Assessment of 300 Species in Florida: Threats from Sea Level Rise, Land Use, and Climate Change*, 8 PLOS ONE (2013).

36. Olivia LeDee et al., *The Challenge of Threatened and Endangered Species Management in Coastal Areas,* 38 COASTAL MGMT. 337, 337 (2010).

37. *See generally* Christopher Craft et al., *Forecasting the Effects of Accelerated Sea-Level Rise on Tidal Marsh Ecosystem Services,* 7 FRONTIERS ECOLOGY & ENV'T 73, 73 (2009); Omar Defeo et al., *Threats to Sandy Beach Ecosystems: A Review,* 81 ESTUARINE, COASTAL & SHELF SCI. 1, 1 (2009); Duncan FitzGerald et al., C*oastal Impacts Due to Sea-Level Rise,* 36 ANN. REV. EARTH & PLANETARY SCI. 601, 601 (2008); Olivia LeDee et al., *The Challenge of Threatened and Endangered Species Management in Coastal Areas,* 38 COASTAL MGMT. 337, 337 (2010); Shaily Menon et al., *Preliminary Global Assessment of Terrestrial Biodiversity Consequences of Sea-Level Rise Mediated by Climate Change*, 19 BIODIVERSITY & CONSERVATION 1599, 1599 (2010); Reed Noss, *Between the Devil and the Deep Blue Sea: Florida's Unenviable Position with Respect to Sea Level Rise,* 107 CLIMATIC CHANGE 1, 1 (2011); Donald Scavia et al., *Climate Change Impacts on U.S. Coastal and Marine Ecosystems,* 25 ESTUARIES 149, 149 (2002).

38. Jaclyn Lopez, *Biodiversity on the Brink: The Role of "Assisted Migration" in Managing Endangered Species Threatened with Rising Seas,* 39 HARV. ENV'T L. REV. 157, 157 (2014).

39. Reed Noss et al., *Conservation Biology and Carnivore Conservation in Rocky Mountains,*10 CONSERVATION BIOLOGY 949, 949 (1996); Rosie Woodroffe & Joshua Ginsberg, *Edge Effects and the Extinction of Populations Inside Protected Areas*, 280 SCI. 2126, 2126 (1998).

40. 16 U.S.C. § 1531(a)(3).

41. 16 U.S.C. § 1532(3).

significantly to the preservation of species at risk of extinction due to climate change. However, political interference and other undefined resistance can result in delays and maladministration of the Act. This section explores some specific case studies of ESA implementation and enforcement challenges in Florida.

Sea Level Rise – Listing – Florida Keys Mole Skink

The Florida Keys mole skink is a small, coastal reptile found only in the Florida Keys.[42] It makes its home in the wrack lines of these low-lying islands and is urgently threatened by sea level rise.[43] For years it languished on the U.S. Fish and Wildlife Service's ("the Service") candidate waiting listing.[44] In 2010, the Center for Biological Diversity ("the Center") petitioned the U.S. Fish and Wildlife Service to list the Florida Keys mole skink under the Endangered Species Act.[45] Finding that the petition presented substantial scientific information indicating that the petitioned action may be warranted, the Service published a positive ninety-day finding on the petition for the skink a year later.[46] After failing to meet the twelve-month statutory deadline to make a final decision on the ESA status of the skink, which Congress set recognizing the urgency with which the agency had to act to prevent extinction, the Center sued to compel the agency to move forward with listing protections.[47] The Service agreed to issue a listing decision by 2017, a full six years after its Congressionally mandated deadline.[48] The

42. *Florida Keys Mole Skink (Eumeces egregius egregius)*, U.S. FISH & WILDLIFE SERV., https://www.fws.gov/species/florida-keys-mole-skink-eumeces-egregius-egregius.

43. *Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Florida Keys Mole Skink and Designation of Critical Habitat*, 87 Fed. Reg. 58648, 58653–55 (Sept. 27, 2022).

44. *Endangered and Threatened Wildlife and Plants; Review of Vertebrate Wildlife for Listing as Endangered or Threatened Species*, 47 Fed. Reg. 58454, 58457, (Dec. 30, 1982); *Endangered and Threatened Wildlife and plants; Review of Vertebrate Wildlife*, 50 Fed. Reg. 37958, 37963 (Sept. 18, 1985); *Endangered and Threatened Wildlife and Plants; Animal Notice of Review*, 54 Fed. Reg. 554, 559 (Jan. 6, 1989); *Endangered and Threatened Wildlife and Plants; Animal Candidate Review for Listing as Endangered or Threatened Species*, 56 Fed. Reg. 58804, 58812 (Nov. 21, 1991); *Endangered and Threatened Wildlife and Plants; Animal Candidate Review for Listing as Endangered or Threatened Species*, 59 Fed. Reg. 58982, 58993 (Nov. 15, 1994).

45. *Petition To List 404 Aquatic, Riparian and Wetland Species from the Southeastern United States as Threatened or Endangered under the Endangered Species Act*, CTR. FOR BIOLOGICAL DIVERSITY (Apr. 10, 2010).

46. Endangered and Threatened Wildlife and Plants; Partial 90-Day Finding on a Petition To List 404 Species in the Southeastern United States as Endangered or Threatened With Critical Habitat, 76 Fed. Reg. 59836 (proposed Sept. 27, 2011).

47. Complaint for Declaratory and Injunctive Relief, Ctr. for Biological Diversity v. Jewell & U.S. Fish and Wildlife Serv., Case 1:13-cv-00975-EGS (D.D.C. June 27, 2013).

48. Stipulated Settlement Agreement, Ctr. for Biological Diversity v. Jewell & U.S. Fish and

Service complied with the court ordered deadline, but found that the skink did not warrant listing.[49]

The Service drew this conclusion despite finding that its primary habitat, Big Pine Key, would experience five inches of sea level rise in the coming decades and one to five feet by the end of the century, theorizing that the skink might be able to "raft" to some other habitable island and survive there.[50] This prompted the Center to sue the Service again, arguing that the Service's conclusions were arbitrary and not supported by the best available science.[51] The United States District Court for the Southern District of Florida agreed, holding that the Service failed to explain why it used outdated models where more current, accurate sea level rise models were available.[52] It also held that the Service arbitrarily failed to explain how the inundation of Big Pine due to sea level rise – projected to be fifty-three percent by 2060 – will impact the survival of the species. The court vacated and remanded the decision to the agency.[53]

In 2022, the Service issued its "12-month finding" – a determination the agency is supposed to issue within twelve months of receiving a petition to list a species – proposing to list the skink as threatened, finding that even under the lowest sea level rise scenario, the skink would lose more than half its primary habitat by 2040.[54] To date, the Service still has not issued a final rule listing the skink under the ESA. Thus, more than a decade after the Service was petitioned to list the species, and more than forty years after the Service itself acknowledged listing may be warranted, the skink still lacks protection under the ESA.

Flooding – Critical Habitat – Florida Bonneted Bat

The Florida bonneted bat is another Florida species threatened by

Wildlife Serv., Case 1:13-cv-00975-EGS (D.D.C. Sept. 23, 2013).

49. Endangered and Threatened Wildlife and Plants; 12-Month Findings on Petitions to List 25 Species as Endangered or Threatened Species. 82 Fed. Reg. 46618 (proposed Oct. 5, 2017) (to be codified at 50 C.F.R. 17).

50. U.S. Fish and Wildlife Service, Species State Assessment Report for the Florida Keys Mole Skink (*Plestioden egregious egregious*) Version 1.1 July 2017 at 71, https://ecos.fws.gov/ServCat/DownloadFile/130463.

51. Ctr. for Biological Diversity v. FWS, 488 F. Supp. 3d 1219, 1222 (S.D. Fla. 2020).

52. *Id.* at 1229.

53. *Id.* at 1231–32.

54. *Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Florida Keys Mole Skink and Designation of Critical Habitat*, 87 Fed. Reg. 58648, 58658.

climate impacts, particularly flooding,[55] that has been waiting patiently for ESA protections for over a decade. The bat is in significant population decline from past habitat loss and pesticide use. It also faces potential future habitat loss, with twenty-three percent of its occupied habitat being at or below six feet in elevation and threatened with tidal flooding and sea level rise.[56] As part of a settlement agreement to clear a backlog of more than 700 species waiting for ESA-protections,[57] the Service proposed listing the bat in 2012.[58] A year later, the Service finalized the endangered listing status of the bat but deferred making a decision on its critical habitat.[59] The ESA requires that the Service issue a critical habitat proposal concurrently with a listing proposal, and in extraordinary cases the Service may extend this deadline by only one year.[60] Five years later, the Service still had not published a critical habitat for proposal, so conservation groups sued to compel a decision in 2018.[61] The Service agreed to publish a decision in 2020,[62] and did so,[63] but after failing to finalize the proposal for two years, conservation groups had to sue again to compel agency action.[64] The Service revised its critical habitat proposal in 2022,[65] but did not immediately finalize the designation. Without final designation, federal agencies authorizing federal activities do not know whether their actions may

55. *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Endangered Florida Bonneted Bat*, 89 Fed. Reg. 16624 (Mar. 7, 2024).

56. *Id.*

57. Stipulated Settlement Agreement, In re Endangered Species Action Section 4 Deadline Litigation, Case 1:10-mc-00377-EGS (D.D.C. July 12, 2011).

58. *Endangered and Threatened Wildlife and Plants; Proposed Endangered Species Status for the Florida Bonneted Bat*, 77 Fed. Reg. 60750 (proposed Oct. 4, 2012).

59. *Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Florida Bonneted Bat*, 78 Fed. Reg. 61004 (Oct. 2, 2013) (codified at 50 C.F.R. 17).

60. *See* 16 U.S.C. § 1533(b)(6)(A)(ii) and 50 C.F.R. § 424.17(b)(2) (explaining that the Service shall, concurrent with publishing a final listing determination, publish final critical habitat designation, or may extend the deadline by one additional year if critical habitat is not yet determinable).

61. Complaint for Declaratory and Injunctive Relief at 2, Ctr. for Biological Diversity et al. v. FWS, No. 1:18-cv-02407 (D.D.C. Oct. 22, 2018).

62. *Beloved Bat to Gain Protected Habitat*, CTR. FOR BIOLOGICAL DIVERSITY (Feb. 12, 2020), https://biologicaldiversity.org/w/news/press-releases/beloved-florida-bat-gain-protected-habitat-2020-02-12/?_gl=1*1pzp3q7*_gcl_au*NjAyOTEyNDMwLjE3MDA3NjI5MTc.

63. *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Florida Bonneted Bat*, 85 Fed. Reg. 35510 (proposed June 10, 2020) (codified at 50 C.F.R. 17).

64. Plaintiff's Complaint for Declaratory and Injunctive Relief at 2, Ctr. for Biological Diversity et al. v. FWS, No. 2:22-cv-14244 (S.D. Fla. July 6, 2022).

65. *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Endangered Florida Bonneted Bat*, 87 Fed. Reg. 71466 (proposed Nov. 22, 2022) (codified at 50 C.F.R. 17).

destroy habitat essential to the conservation of the species and are not required to consult with the Service to determine whether the actions will adversely modify the habitat.[66] The Service recently finalized the critical habitat designation for the Florida bonneted bat in March 2024, more than ten years after proposing to list the bat.[67]

Saltwater Intrusion – 5-Year Status Review – Florida Key Deer

The Florida key deer is an iconic Florida species threatened by climate change. The species has been listed under the ESA since 1967, yet it continues to face troubling threats, including significant habitat loss and vehicle mortality.[68] While incidents like the New World screwworm infestation and Hurricane Irma have pushed the deer even closer to extinction in the last few years,[69] a lesser-known threat is the loss of freshwater resources due to saltwater intrusion.[70] As sea levels rise, freshwater resources become saturated with saltwater. While key deer can tolerate more saline water than humans, the loss of freshwater has already necessitated human intervention with supplemental watering stations.[71]

Despite the critical status of the species, the Service initiated a five-year status review that included a proposal to delist the deer in 2019.[72] This decision was based on a species status assessment that inflated available habitat by inverting the ratio of habitat to deer (rather than 0.22 deer per acre, the Service used 0.22 acres per deer), used inaccurate hurricane frequency data, and relied on additional

66. 16 U.S.C. § 1538(a)(2).

67. *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Endangered Florida Bonneted Bat*, 89 Fed. Reg. 16624, 16644 (Mar. 7, 2024).

68. U.S. Fish and Wildlife Service, Recovery Plan for the Endangered Key Deer, Draft Amendment 1 at 2 (2022), https://ecos.fws.gov/docs/recovery_plan/Key%20deer_recovery%20criteria%20amendment.pdf.

69. Silvy, N.J. et al., *2020 Key Deer Population Estimate*, at 3, https://ecos.fws.gov/ServCat/DownloadFile/199675 (noting that while the screwworm infestation killed 135 deer, Hurricane Irma caused a 40% decline in population due to deer drowning and losing freshwater and food sources).

70. *See id.* ("The longer-lasting impacts of Hurricane Irma on the ecosystem (e.g., freshwater salinization in upland areas) also added uncertainty to Key deer post-hurricane recovery potential.").

71. Jan Svejkovsky, *Salinity Concentration Monitoring of Fresh Water Holes in the Lower-Florida Keys*, 2-Year Summary Report, Research and Monitoring Special Use Permit #FY19-03 (2021).

72. *Trump Administration to Strip Florida Key Deer of Federal Protection*, CTR. FOR BIOLOGICAL DIVERSITY (Aug. 14, 2019), https://biologicaldiversity.org/w/news/press-releases/trump-administration-strip-florida-key-deer-federal-protection-2019-08-14/email_view/?_gl=1*u26m4h*_gcl_au*NjAyOTEyNDMwLjE3MDA3NjI5MTc.

climate data from a well-known climate denial group that receives half of its funding from an oil company.[73] The Service's move to unlawfully delist the deer was only thwarted by a leak to the media and pressure from the conservation community in the Keys.[74] Had these efforts been unsuccessful, the key deer would have lost all ESA protections and been left to fend for itself against sprawl, sea level rise, car collisions, disease, and loss of freshwater. Even though a formal investigation into the scientific integrity of the proposal corroborated the irregularities, it did not result in any findings of intentional wrongdoing.[75]

Heat – Consultation – Caribbean Corals

Caribbean coral, such as elkhorn and staghorn coral, suffered massive warmwater-related die offs due to record breaking heat in July 2023.[76] These two coral were among the first species listed under the ESA due to climate change,[77] and the strength of the protections for them should come from the Section 7 consultation process of the Endangered Species Act. Under Section 7, agencies undertaking federal actions are required to consult with expert agencies – the U.S. Fish and Wildlife Service and the National Marine Fisheries Service – to ensure their activities do not jeopardize the continued existence of the species or adversely modify their critical habitat.[78] Where global

73. *Re: Climate Denial and Rejection of Scientific Integrity in the U.S. Fish and Wildlife Service's Regulatory Agenda*, CTR. FOR BIOLOGICAL DIVERSITY (Dec. 13, 2021), https://biologicaldiversity.org/species/pdfs/Center-Letter-USFWS-Delisting-Actions-20211213.pdf.

74. Jan Staletovich, *Feds Quietly Announce Plans to Change Protections for Florida Panther and Key Deer*, WLRN 91.3 FM (Dec. 15, 2021), https://www.wlrn.org/news/2021-12-15/feds-quietly-announce-plans-to-change-protections-for-florida-panther-and-key-deer; Jan Staletovich, *Federal Wildlife Managers are Updating a Plan to Save the Key Deer. Conservationists Say it's Too Vague*, WLRN 91.3 FM (Aug. 17, 2022), https://www.wlrn.org/news/2022-08-17/federal-wildlife-managers-are-updating-a-plan-to-save-the-key-deer-conservationists-say-its-too-vague.

75. Letter from Dave Scott and Byron Shumate to Dan Ritzman and Jaclyn Lopez, Aug. 17, 2021 at 4.

76. *NASA Clocks July 2023 as Hottest Month on Record Ever Since 1880,* NASA (Aug. 14, 2023) https://climate.nasa.gov/news/3279/nasa-clocks-july-2023-as-hottest-month-on-record-ever-since-1880/#:~:text=Overall%2C%20July%202023%20was%200.43%20degrees%20Fahrenheit%20%28F%29,than%20the%20average%20July%20between%201951%20and%201980.

77. *Endangered and Threatened Species: Final Listing Determinations for Elkhorn Coral and Staghorn Coral*, 71 Fed. Reg. 26852, 26853 (May 9, 2006); *Elkorn Coral*, CTR. FOR BIOLOGICAL DIVERSITY, https://www.biologicaldiversity.org/species/invertebrates/elkhorn_coral (last visited Mar. 30, 2024).

78. 16 U.S.C. § 1536(a)(2).

factors like climate change can devastate populations of coral,[79] consultation on federal actions with localized impacts can help keep the species from going extinct.[80] Unfortunately, the agencies do not always consult using the best available science. For example, in 2016, conservation organizations had to sue the U.S. Army Corps of Engineers ("the Corps") for its plans to dredge a port expansion at Port Everglades.[81] The Corps' approval of the Port Everglades proposal relied on studies on climate change's effects on corals, which were previously proven inadequate at the nearby failed dredge at the Port of Miami.[82] The Corps ultimately agreed to redo its studies[83] but seven years later it attempted to use the same flawed research to justify another channel dredge project in Puerto Rico.[84] Once again, non-governmental groups stepped in to sue.[85] At the time of writing, the case is currently pending before the D.C. Circuit Court, and oral arguments took place on January 23, 2024.[86]

While the ESA can protect imperiled biodiversity, the agencies charged with protecting that biodiversity must be continually prodded and corrected to take action. The ESA design is simple, yet its implementation has proven challenging, principally due to political interference and chronic underfunding.

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79. *How Does Climate Change Affect Coral Reefs?*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://oceanservice.noaa.gov/facts/coralreef-climate.html (last visited Mar. 30, 2024).

80. *Threats to Coral Reefs*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/coral-reefs/threats-coral-reefs (last visited Mar. 30, 2024).

81. Rachel Silverstein et al., *Port Everglades Project Would Repeat Environmental Destruction Caused by PortMiami Dredging*, CTR. FOR BIOLOGICAL DIVERSITY (Aug. 17, 2016), https://www.biologicaldiversity.org/news/press_releases/2016/port-everglades-08-17-2016.html.

82. *Id.*

83. Rachel Silverstein et al., *U.S. Army Corps of Engineers Commits to Conduct New Environmental Studies Before Port Everglades Expansion Dredging Begins*, CTR. FOR BIOLOGICAL DIVERSITY (Jan. 23, 2017), https://www.biologicaldiversity.org/news/press_releases/2017/port-everglades-01-23-2017.php.

84. Brief Of Amici Curiae Toabajeños En Defensa Del Ambiente, Amigx Del M.A.R., Rachel Silverstein, Ph.D., And Abel Valdivia, Ph.D. In Support Of Plaintiffs-Appellants at 26–28, El Puente De Williamsburg, Coralations, Center For Biological Diversity v. U.S. Army Corps Of Engineers, Lieutenant General Scott A. Spellmon, National Marine Fisheries Service, Gina Raimondo, U.S. Fish And Wildlife Service, Debra Haaland, (2023) (No. 23-5189).

85. *See* Federico Cintrón Moscoso et al., *Corps Schedules Massive Dredging Project Despite Public Health, Environmental Objections*, CTR. FOR BIOLOGICAL DIVERSITY (Jan. 30, 2023), https://biologicaldiversity.org/w/news/press-releases/corps-schedules-massive-dredging-project-despite-public-health-environmental-objections-2023-01-30/ (discussing a pending lawsuit against the U.S. Army Corps of Engineers challenging its dredging project in San Juan Bay, Puerto Rico).

86. *Public Calendar from 06/01/2023 through 05/25/2024*, U.S. CT. OF APPEALS FOR THE D.C. CIR., https://www.cadc.uscourts.gov/internet/sixtyday.nsf/fullcalendar?OpenView&count=1000 (last accessed Mar. 26, 2024).

ADAPTATION STRATEGIES DO NOT ADEQUATELY CONSIDER BIODIVERSITY

Given these implementation struggles, it is no wonder that the ESA, while designed to conserve and protect species, is falling short in protecting them from climate change and human adaptations to climate change. Many coastal communities are scrambling to prepare for the increasingly severe effects of climate change.[87]

To "adapt" to the climate crisis future, Ruhl and Craig warn that society will need to employ "transformational adaptation measures as radical as the pace and intensity of changing conditions beyond 2°C."[88] Indeed, "adaptation is not just about *preserving* societies in their current state; rather, it always implies a *transformative* project."[89] Managed retreat, also sometimes called managed realignment, refers to the movement of people or infrastructure from areas that are or will soon become hostile to life.[90] This can be done passively through abandonment or actively through avoidance and relocation.[91] Examples of such active retreat include setbacks, rolling easements, land acquisition, and zoning.[92] In the climate context, such mass exodus has typically occurred after disaster events as opposed to being

87. *See* James Hansen et al., *The Case for Young People and Nature: A Path to a Healthy, Natural, Prosperous Future* 1, 2 (2011) https://www.columbia.edu/~jeh1/mailings/2011/20110505_CaseForYoungPeople.pdf ("Ice sheet disintegration would cause continual shoreline adjustments with massive civil engineering cost implications as well as widespread heritage loss in the nearly uncountable number of coastal cities."). To adapt to climate change, communities are undertaking efforts to advance the line, hold the line, abandon the line, or relocate the line. *See* Sofie Storbjork & Mattias Hjerpe, *Climate-Proofing Coastal Cities: What is Needed to Go from Envisioning to Enacting Multifunctional Solutions for Waterfront Climate Adaptation?*, 210 OCEAN & COASTAL MGMT. (2021) (discussing coastal protection planning options in four Swedish cities); Michael Robert Phillips, et al., *Climate Change, Coastal Management and Acceptable Risk: Consequences for Tourism*, 85 J. COASTAL RSCH. (SPECIAL ISSUE) 1411, 1411 (2018) (defining the four main approaches to coastline management: advancing the line, holding the line, abandoning the line, and relocating the line).

88. J.B. Ruhl & Robin Kundis Craig, *4°C,* 106 MINN. L. REV. 191, 201 (2021).

89. Benoit Mayer, *Climate Change Adaptation and the Law*, 39 VA. ENV'T L. J. 141, 150 (2021).

90. *See* Leah Dundon & Mark Abkowitz, *Climate-Induced Managed Retreat in the U.S.: A Review of Current Research*, 33 CLIMATE RISK MGMT. 1, 1 (2021) (defining managed retreated as "the basic concept of permanently moving people or infrastructure out of harm's way").

91. William Neal et al., *Managed Retreat*, *in* ENCYCLOPEDIA COASTAL SCI. 1101, 1103 (C.W. Finkl & C. Makowski eds., 2017); Phillips, *supra* note 87.

92. Sofie Storbjork & Mattias Hjerpe, *Climate-Proofing Coastal Cities: What is Needed to Go from Envisioning to Enacting Multifunctional Solutions for Waterfront Climate Adaptation?*, 210 OCEAN & COASTAL MGMT. 1, 2 (2021); Idowu Ajibade et al., *Why Climate Migration is Not Managed Retreat: Six Justifications*, 65 GLOB. ENV'T CHANGE 1, 2 (2020).

proactive planned.[93] However, managed retreat may not always be an option. Lack of funding, scarcity of relocation sites, and an unwillingness of affected people to leave a hazard site might be insurmountable obstacles.[94] Likewise, some adaptations to climate change, like buyout programs, can have unintended consequences, such as decreasing local tax revenue and disrupting the social fabric of a community.[95]

Resilience is another path some communities are attempting to follow. Resilience lacks a single definition. The U.S. Army Corps of Engineers describes resilient systems as those that "avoid or decrease exposure, add redundancy, or increase robustness."[96] Resilience can also mean the ability of a natural system to absorb, weather, and correct itself after a disturbance.[97] From an anthropocentric perspective, resilience can refer to how quickly a community's economy will recover following a storm.[98] Professor Craig Anthony Arnold provides a compelling perspective on community resilience, defining it as "the capacity of a community to adapt to disturbances while retaining its core functions and structure and to thrive in an environment characterized by change through capacity building."[99] Arnold observes that "vulnerability" is the "functional opposite" and describes four characteristics of a resilient community as having (1) "the strength to resist unwanted disturbance," (2) "the recovery

93. *See Displacement, Disasters and Climate Change*, INTERNAL DISPLACEMENT MONITORING CENTRE (IDMC) (Dec. 2022), https://www.internal-displacement.org/focus-areas/Displacement-disasters-and-climate-change/ (discussing the role played by climate-related natural disasters in displacing millions of people around the world).

94. *See* Andrew Dannenberg et al, *Managed Retreat as a Strategy for Climate Change Adaptation in Small Communities: Public Health Implications*, 153 CLIMATIC CHANGE 1, 9 (2019) (discussing the challenges communities face when trying to carry out managed retreat).

95. *See* Sherri Brokopp Binder et al., *Rebuild or Relocate? Resilience and Postdisaster Decision-Making After Hurricane Sandy*, 56 AM. J. CMTY. PSYCH. 180, 193 (2015) (discussing the importance of community level factors in the individual's decisions whether to participate in a buyout program after a natural disaster); *see also* Daniel H. de Vries et al., *Citizenship Rights and Voluntary Decision Making in Post-Disaster U.S. Floodplain Buyout Mitigation Program*, 30 INT'L J. MASS EMERGENCIES & DISASTERS 1, 2 (2012) ("Dissolving entire neighborhoods via acquisition and relocation programs is the most socially dramatic and permanent solution to floodplain de-population . . . [s]ocial impacts can include disruption of community relationships . . . ").

96. *See* U.S. ARMY CORPS OF ENG'RS, COASTAL RISK REDUCTION AND RESILIENCE: USING THE FULL ARRAY OF MEASURES 2, (2013).

97. Robin K. Craig, *"Stationarity Is Dead" – Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENV'T L. REV. 9, 22 (2010).

98. Phillips, *supra* note 87 at 1414.

99. Craig Anthony Arnold, *Resilience Justice and Urban Water Planning*, 52 SETON HALL L. REV. 1399, 1417 (2022).

capacity to bounce back," (3) "the flexibility to adapt to changing conditions," and (4) "the transformative capacity to use disturbances and changes to restructure itself."[100]

Nature-based solutions "are often 'no or low-regret' options because they serve multiple functions, reduce vulnerability, and help build resilience."[101] In addition to providing habitat for biodiversity, the conservation of natural systems provides superior benefits for human communities as compared to human-engineered systems.[102] Arnold details the benefits of "green and blue infrastructure" in adding resilience for vulnerable communities.[103] Such "infrastructure" includes "tree and forests; vegetation, wildlife, and wildlife habitat; parks and recreational lands; biotic infiltration and retention of stormwater; waterways, wetlands, and watershed lands; agricultural lands and soils, including produce gardens and orchards; open space, corridors, and linkages; and oceans, marine systems, and coastal lands."[104] Arnold's observations move beyond the obvious ecosystem benefits of this infrastructure and highlight their importance in providing space for "friendship and social networks" and "mental, emotional, and physical health, as well as child development and identity formation."[105]

ASSISTED MIGRATION IS ONE POLICY PRESCRIPTION FOR HELPING SPECIES SURVIVE CLIMATE CHANGE

Assisted migration is one strategy recommended in recovery plans, but it has limitations. Recovery plans are the Service's and the National Marine Fisheries Service's maps for species recovery and list

100. *Id.* at 1417–18.

101. A.D. Guerry et al., *Protection and Restoration of Coastal Habitats Yield Multiple Benefits for Urban Residents as Sea Levels Rise*, NPJ URB. SUSTAINABILITY 1, 8 (June 9, 2022); *see also Building Community Resilience with Nature-Based Solutions: A Guide for Local Officials*, FED. EMERGENCY MGMT. AGENCY, 11–12 (June 2021), https://www.fema.gov/sites/default/files/documents/fema_riskmap-nature-based-solutions-guide_2021.pdf (discussing community co-benefits of implementing nature-based solutions, including improved water quality and increased property values); *What You Need to Know About Nature-Based Solutions to Climate Change*, THE WORLD BANK (May 19, 2022), https://www.worldbank.org/en/news/feature/2022/05/19/what-you-need-to-know-about-nature-based-solutions-to-climate-change (discussing reductions in flood risk from utilizing nature-based solutions).

102. *Id*.

103. Craig Anthony Arnold, *Resilience Justice and Community-Based Green and Blue Infrastructure*, 45 WM. & MARY ENV'T. L. & POL'Y REV. 665, 666 (2021).

104. *Id.* at 673–74.

105. *Id.* at 677.

recovery goals, the criteria necessary to recover the species, and anticipated timelines for project implementation and species recovery.[106] Many recovery plans call for assisted migration,[107] but it is unclear how often it is implemented. The Inflation Reduction Act set aside $62.5 million for the Department of Interior to prioritize recovery plan implementation for 300 species.[108] That Congress set aside funding specifically for recovery planning appears to demonstrate some understanding of the urgency of this planning. Relatedly, the Service recently adopted a National Park Service "Resist-Accept-Direct" framework to guide agency decision-making to manage governmental responses to climate change related ecosystem transformation, which also addresses assisted migration by directing resource managers to "actively shap[e] ecosystem change toward preferred new conditions."[109]

Wildlife managers utilize assisted migration to help strengthen imperiled plants and animals' resiliency to climate change.[110] Regarding migration, sometimes this involves passively assisting plants and animals by designing critical habitats that allow the species to move on its own.[111] Active migration calls for the planned translocation of a plant or animal from a high-risk area to a lower risk area, or an expansion of the range or redundancy in multiple populations to aid in resilience.[112] But this active, assisted migration has its own perils. The National Park Service created a protocol to evaluate risks involved in assisting the migration of particular species.[113] Areas of concern include the risk of taking no action (including impacts to the target species and recipient ecosystem), the risk of the relocation to the target species and

106. 16 U.S.C. § 1533(f)(1)(B)(i)-(iii).

107. *See* Appendix A.

108. *See* Press Release, Dep't of the Interior, *Biden-Harris Administration Announces $62.5 Million Through Investing in America Agenda for Endangered Species Recovery Planning* (May 19, 2023), https://www.doi.gov/pressreleases/biden-harris-administration-announces-625-million-through-investing-america-agenda.

109. *Resist-Accept-Direct (RAD) – A Framework for the 21st-Century Natural Resource Manager*, NAT'L PARK SERVICE 6 (Jan. 19, 2021), https://www.nps.gov/subjects/climatechange/radframework.htm; *see Resist-Accept-Direct (RAD) Webinar Series*, U.S. FISH & WILDLIFE SERV., https://www.fws.gov/training/webinar/resist-accept-direct-framework (last visited Apr. 4, 2024) (providing access to webinars to inform natural resources managers from the agency about utilizing this framework).

110. *See* Appendix A.

111. Lopez, *supra* note 38, at 169–70 (describing critical habitats and the role they play in passive migration).

112. *Id.* at 175.

113. Aviv Karasov-Olson et al., *Ecological Risk Assessment of Managed Relocation as a Climate Change Adaptation Strategy*, NAT'L PARK SERV. (2021).

on non-target species in the ecosystem, the risk of relocation on the recipient ecosystem and potential invasion, and the risk associated with socio-economic values.[114] Another factor is social carrying capacity, or the human population's capacity to accept the introduced species.[115]

Although many plants and animals are listed under the ESA due to climate threats, many lack recovery plan actions that specifically address these threats.[116] However, there is good news. The Service recently finalized new rules on reintroducing species outside their historic range to provide for their conservation, particularly in anticipation of climate change.[117] The Service revised these regulations specifically to facilitate the conservation of species threatened by climate change.[118] This is a positive development that will hopefully lead to clearheaded planning that proactively addresses the needs of our nation's most imperiled biodiversity and ecosystems.

CONCLUSION

Climate change already affects where biodiversity can thrive. The ESA provides many tools to ensure the best protection against extinction. Misadministration and weak implementation of the ESA obstructs rapid relief, as do some adaptation strategies. Assisted migration, particularly as implemented through the ESA, can be better integrated with adaptation strategies to ensure species survival.

114. *Id*. at 10.

115. Nathan Rott, *Shrinking Habitat Raises Questions About How to Save Endangered Key Deer*, NPR (Oct. 31, 2023), https://www.npr.org/2023/10/31/1209644541/shrinking-habitat-raises-questions-about-how-to-save-endangered-key-deer (explaining the difficulties and risks associated with saving the Key deer); Chad Gillis, *Panther Status Change Could Open South Florida Preserve Lands to Development*, NEWS-PRESS (July 26, 2023), https://www.news-press.com/story/news/environment/2023/07/26/florida-panther-feds-hinted-at-listing-change-but-no-news-yet/70461636007/ (describing the costs of regulatory inaction with the Florida panther).

116. *See* Appendix A.

117. Endangered and Threatened Wildlife and Plants; Designation of Experimental Populations, 88 Fed. Reg. 42642 (July 3, 2023) (codified at 50 C.F.R. 17).

118. *Id.*

APPENDIX A

Common Name	***Scientific Name***	**Addresses Climate Change, Storms, Sea Level Rise**	**Calls for (Re)-introduction/ Translocation**	**Latest Draft**	**Recovery Plan URL**
Alabama pearlshell	*Margaritifera marrianae*	NO	NO	2012	https://ecos.fws.gov/docs/recovery_plan/20121113_Recovery Outline for 8 Gulf Coast Mussels_FINAL.pdf
Blue-tailed mole skink	*Eumeces egregius lividus*	NO	NO	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Chipola slabshell	*Elliptio chipolaensis*	NO	NO	2019	https://ecos.fws.gov/docs/recovery_plan/Chipola slabshell Recovery Plan Amendment.pdf
Choctaw bean	*Obovaria choctawensis*	NO	NO	2012	https://ecos.fws.gov/docs/recovery_plan/20121113_Recovery Outline for 8 Gulf

					Coast Mussels_FINAL.pdf
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	NO	NO	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Fragrant prickly-apple	*Cereus eriophorus var. fragrans*	NO	NO	2019	https://ecos.fws.gov/docs/recovery_plan/Fragrant Pickly-Apple Recovery Plan Amendment.pdf
Fuzzy pigtoe	*Pleurobema strodeanum*	NO	NO	2012	https://ecos.fws.gov/docs/recovery_plan/20121113_Recovery Outline for 8 Gulf Coast Mussels_FINAL.pdf
Gulf sturgeon	*Acipenser oxyrinchus (=oxyrhynchus) desotoi*	NO	NO	1995	https://ecos.fws.gov/docs/recovery_plan/950922.pdf
Ivory-billed woodpecker	*Campephilus principalis*	NO	NO	2010	https://ecos.fws.gov/docs/recovery_plan/100719.pdf

Narrow pigtoe	*Fusconaia escambia*	NO	NO	2012	https://ecos.fws.gov/docs/recovery_plan/20121113_Recovery Outline for 8 Gulf Coast Mussels_FINAL.pdf
Round Ebonyshell	*Reginaia rotulata*	NO	NO	2012	https://ecos.fws.gov/docs/recovery_plan/20121113_Recovery Outline for 8 Gulf Coast Mussels_FINAL.pdf
Sand skink	*Neoseps reynoldsi*	NO	NO	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Southern kidneyshell	*Ptychobranchus jonesi*	NO	NO	2012	https://ecos.fws.gov/docs/recovery_plan/20121113_Recovery Outline for 8 Gulf Coast Mussels_FINAL.pdf
Southern Sandshell	*Hamiota australis*	NO	NO	2012	https://ecos.fws.gov/docs/recovery

					_plan/20121113_Recovery Outline for 8 Gulf Coast Mussels_FINAL.pdf
Stock Island tree snail	*Orthalicus reses (not incl. nesodryas)*	NO	NO	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Suwannee moccasinshell	*Medionidus walkeri*	NO	NO	2016	https://ecos.fws.gov/docs/recovery_plan/2016.12.16_recovery_outline_suwannee_mocc.pdf
Tapered pigtoe	*Fusconaia burkei*	NO	NO	2012	https://ecos.fws.gov/docs/recovery_plan/20121113_Recovery Outline for 8 Gulf Coast Mussels_FINAL.pdf
West Indian Manatee	*Trichechus manatus*	NO	NO	2001	https://ecos.fws.gov/docs/recovery_plan/011030.pdf
Wood stork	*Mycteria americana*	NO	NO	1991	https://ecos.fws.gov/docs/recovery_plan/9701

					27.pdf
American crocodile	*Crocodylus acutus*	YES	NO	2019	https://ecos.fws.gov/docs/recovery_plan/American crocodile Recovery Plan Amendment.pdf
Atlantic salt marsh snake	*Nerodia clarkii taeniata*	YES	NO	1993	https://ecos.fws.gov/docs/recovery_plan/931215.pdf
Choctawhatchee beach mouse	*Peromyscus polionotus allophrys*	YES	NO	2019	https://ecos.fws.gov/docs/recovery_plan/Choctawhatchee Beach Mouse_Final_12-6-2019.pdf
Eastern Black rail	*Laterallus jamaicensis ssp. jamaicensis*	YES	NO	2021	https://ecos.fws.gov/docs/recovery_plan/20210318_EBLRA_Recovery Outline_signed (1).pdf
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	YES	NO	2019	https://ecos.fws.gov/docs/recovery_plan/Everglades Snail Kite

					Recovery Plan Amendment_1.pdf
Florida bonneted bat	*Eumops floridanus*	YES	NO	2018	https://ecos.fws.gov/docs/recovery_plan/Final FLBB recovery outline.pdf
Florida salt marsh vole	*Microtus pennsylvanicus dukecampbelli*	YES	NO	2019	https://ecos.fws.gov/docs/recovery_plan/Florida Salt Marsh Vole Recovery Plan Amendement_1.pdf
Green sea turtle	*Chelonia mydas*	YES	NO	1991	https://ecos.fws.gov/docs/recovery_plan/911126c.pdf
Hawksbill sea turtle	*Eretmochelys imbricata*	YES	NO	1993	https://ecos.fws.gov/docs/recovery_plan/931110.pdf
Leatherback sea turtle	*Dermochelys coriacea*	YES	NO	1998	https://ecos.fws.gov/docs/recovery_plan/981201d.pdf
Loggerhead sea turtle	*Caretta caretta*	YES	NO	2008	https://ecos.fws.gov/docs/recovery_plan/090116.pdf

Perdido Key beach mouse	*Peromyscus polionotus trissyllepsis*	YES	NO	2019	https://ecos.fws.gov/docs/recovery_plan/Perdido Key Beach Mouse_Final_12-6-2019.pdf
Avon Park harebells	*Crotalaria avonensis*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Beach jacquemontia	*Jacquemontia reclinata*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Britton's beargrass	*Nolina brittoniana*	NO	YES	1996	https://ecos.fws.gov/docs/recovery_plan/960622.pdf
Carter's mustard	*Warea carteri*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf

Crested caracara (Audubon's) [Florida Distinct Population Segment]	*Polyborus plancus audubonii*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Fat threeridge (mussel)	*Amblema neislerii*	NO	YES	2003	https://ecos.fws.gov/docs/recovery_plan/030930.pdf
Florida bonamia	*Bonamia grandiflora*	NO	YES	1996	https://ecos.fws.gov/docs/recovery_plan/960622.pdf
Florida golden aster	*Chrysopsis floridana*	NO	YES	1988	https://ecos.fws.gov/docs/recovery_plan/060227.pdf
Florida panther	*Puma (=Felis) concolor coryi*	NO	YES	2008	https://ecos.fws.gov/docs/recovery_plan/081218.pdf
Florida scrub-jay	*Aphelocoma coerulescens*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/20190926 Florida Scrub-Jay Revised Recovery Plan_1a.pdf
Florida skullcap	*Scutellaria floridana*	NO	YES	1994	https://ecos.fws.gov/docs/recovery_plan/9406

					22.pdf
Florida torreya	*Torreya taxifolia*	NO	YES	1986	https://ecos.fws.gov/docs/recovery_plan/FL torreya recov plan.pdf
Florida ziziphus	*Ziziphus celata*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Garber's spurge	*Chamaesyce garberi*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Garrett's mint	*Dicerandra christmanii*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Godfrey's butterwort	*Pinguicula ionantha*	NO	YES	1994	https://ecos.fws.gov/docs/recovery_plan/940622.pdf

Gulf moccasinshell	*Medionidus penicillatus*	NO	YES	2003	https://ecos.fws.gov/docs/recovery_plan/030930.pdf
Highlands scrub hypericum	*Hypericum cumulicola*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Key deer	*Odocoileus virginianus clavium*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Lakela's mint	*Dicerandra immaculata*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lakela_s Mint Recovery Plan Amendment.pdf
Lewton's polygala	*Polygala lewtonii*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Longspurred mint	*Dicerandra cornutissima*	NO	YES	1987	https://ecos.fws.gov/docs/recovery_plan/060313d.pdf

Miami Blue Butterfly	*Cyclargus (=Hemiargus) thomasi bethunebakeri*	NO	YES	2012	https://ecos.fws.gov/docs/recovery_plan/2012final Miami blue Rec Outline SFESO.pdf
Okeechobee gourd	*Cucurbita okeechobeensis ssp. okeechobeensis*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Okeechobee Gourd Recovery Plan Amendment_1.pdf
Oval pigtoe	*Pleurobema pyriforme*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Gulf Moccasinshell, Oval Pigtoe, Purple Bankclimber, Shinyrayed Pocketbook Recovery Plan Amendment.pdf
Panama City crayfish	*Procambarus econfinae*	NO	YES	2022	https://ecos.fws.gov/docs/recovery_plan/Panama City Crayfish Recovery

					Outline_20221219.pdf
Papery whitlow-wort	*Paronychia chartacea*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Pigeon wings	*Clitoria fragrans*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Purple bankclimber (mussel)	*Elliptoideus sloatianus*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Gulf Moccasinshell, Oval Pigtoe, Purple Bankclimber, Shinyrayed Pocketbook Recovery Plan Amendment.pdf
Pygmy fringe-tree	*Chionanthus pygmaeus*	NO	YES	1999	https://ecos.fws.gov/docs/recovery_plan/140903.pdf
Rugel's pawpaw	*Deeringothamnus rugelii*	NO	YES	1988	https://ecos.fws.gov/docs/recovery_plan/060313e.pdf

Sandlace	*Polygonella myriophylla*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Scrub blazingstar	*Liatris ohlingerae*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Scrub buckwheat	*Eriogonum longifolium var. gnaphalifolium*	NO	YES	1996	https://ecos.fws.gov/docs/recovery_plan/960622.pdf
Scrub lupine	*Lupinus aridorum*	NO	YES	1996	https://ecos.fws.gov/docs/recovery_plan/960622.pdf
Scrub mint	*Dicerandra frutescens*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan

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Scrub plum	*Prunus geniculata*	NO	YES	1996	https://ecos.fws.gov/docs/recovery_plan/960622.pdf
Shinyrayed pocketbook	*Hamiota subangulata*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Gulf Moccasinshell, Oval Pigtoe, Purple Bankclimber, Shinyrayed Pocketbook Recovery Plan Amendment.pdf
Short-leaved rosemary	*Conradina brevifolia*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Snakeroot	*Eryngium cuneifolium*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge

					Plants Recovery Plan Amendment_1.pdf
Telephus spurge	*Euphorbia telephioides*	NO	YES	1994	https://ecos.fws.gov/docs/recovery_plan/940622.pdf
White birds-in-a-nest	*Macbridea alba*	NO	YES	1994	https://ecos.fws.gov/docs/recovery_plan/940622.pdf
Wireweed	*Polygonella basiramia*	NO	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lake Wales Ridge Plants Recovery Plan Amendment_1.pdf
Anastasia Island beach mouse	*Peromyscus polionotus phasma*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Anastasia Island Beach Mouse Recovery Plan Amendement_1.pdf
Apalachicola rosemary	*Conradina glabra*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Conr

					adina glabra Recovery Plan Amendment.pdf
Bartram's hairstreak Butterfly	*Strymon acis bartrami*	YES	YES	2014	https://ecos.fws.gov/docs/recovery_plan/20141126_Recovery Outline_Bartrams hairstreak.pdf
Beautiful pawpaw	*Deeringothamnus pulchellus*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Beautiful Pawpaw Recovery Plan Amendment.pdf
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Cape Sable Seaside Sparrow Recovery Plan Amendment.pdf
Crenulate lead-plant	*Amorpha crenulata*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Pine

					Rocklands Recovery Plan Amendment_1.pdf
Deltoid spurge	*Chamaesyce deltoidea ssp. deltoidea*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Pine Rocklands Recovery Plan Amendment_1.pdf
Eastern indigo snake	*Drymarchon couperi*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/2019_E indigo snake_RIS_DRAFT_1.pdf
Florida brickell-bush	*Brickellia mosieri*	YES	YES	2015	https://ecos.fws.gov/docs/recovery_plan/2016.06.24_recovery_outline_FL_bricknell_bush.pdf
Florida bristle fern	*Trichomanes punctatum ssp. floridanum*	YES	YES	2018	https://ecos.fws.gov/docs/recovery_plan/final FL bristle fern recovery outline.pdf

Florida grasshopper sparrow	*Ammodramus savannarum floridanus*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Florida Grasshopper Sparrow Recovery Plan Amendment_1.pdf
Florida leafwing Butterfly	*Anaea troglodyta floridalis*	YES	YES	2014	https://ecos.fws.gov/docs/recovery_plan/20141126_Recovery Outline_Florida leafwing_ MS revisions.pdf
Florida perforate cladonia	*Cladonia perforata*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Florida Perforate Cladonia Recovery Plan Amendment_2.pdf
Florida semaphore Cactus	*Consolea corallicola*	YES	YES	2013	https://ecos.fws.gov/docs/recovery_plan/3 SOFL plants_FL semaphore cactus_reco

					very outline (2013).pdf
Four-petal pawpaw	*Asimina tetramera*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Four-Petal Pawpaw Recovery Plan Amendment.pdf
Frosted flatwoods salamander	*Ambystoma cingulatum*	YES	YES	2021	https://ecos.fws.gov/docs/recovery_plan/20210615_Frosted_Flatwoods salamander_RP.pdf
Gentian pinkroot	*Spigelia gentianoides*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Spigelia gentianoides Recovery Plan Amendment.pdf
Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Key Largo Cotton Mouse Recovery Plan

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Key Largo woodrat	*Neotoma floridana smalli*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Key Largo Wood Rat Recovery Plan Amendment_1.pdf
Key tree cactus	*Pilosocereus robinii*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Key Tree-cactus Recovery Plan Amendment.pdf
Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Lower Keys Marsh Rabbit Recovery Plan Amendment_1.pdf
Ochlockonee moccasinshell	*Medionidus simpsonianus*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Ochlockonee Moccasinshell Recovery

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Red-cockaded woodpecker	*Picoides borealis*	YES	YES	2003	https://ecos.fws.gov/docs/recovery_plan/030320_2.pdf
Reticulated flatwoods salamander	*Ambystoma bishopi*	YES	YES	2021	https://ecos.fws.gov/docs/recovery_plan/20210615_RETICULATED_Flatwoods_Salamander_RP.pdf
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Schaus_ Sallowtail Butterfly Recovery Plan Amendment.pdf
Silver rice rat	*Oryzomys palustris natator*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Silver Rice Rat Recovery Plan Amendment_1.pdf
Small's milkpea	*Galactia smallii*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Pine

					Rocklands Recovery Plan Amendment_1.pdf
Southeastern beach mouse	*Peromyscus polionotus niveiventris*	YES	YES	1993	https://ecos.fws.gov/docs/recovery_plan/930923b.pdf
St. Andrew beach mouse	*Peromyscus polionotus peninsularis*	YES	YES	2010	https://ecos.fws.gov/docs/recovery_plan/20110104_SABM_recov_plan_FINAL.pdf
Tiny polygala	*Polygala smallii*	YES	YES	2019	https://ecos.fws.gov/docs/recovery_plan/Pine Rocklands Recovery Plan Amendment_1.pdf