FEDERAL INVASIVE ALIEN SPECIES POLICY: INCREMENTAL APPROACHES AND THE PROMISE OF COMPREHENSIVE REFORM

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ABSTRACT

The term Invasive Alien Species (IAS)—referring to plants, animals, pathogens, and other organisms introduced through anthropogenic activity into biogeographic areas outside of their historic range—are likely to cause economic and environmental harm.[1] IAS can negatively impact ecosystem processes, decrease native species abundance and richness, minimize overall genetic diversity, disturb the structure of natural communities, can pose a direct threat to imperiled native species, and adversely affect human health. Drivers in the United States for the spread of IAS include: plant and pet imports, habitat destruction, land use change, transportation pathways, marine debris, ballast water discharges, aquaculture and importation of live foods, legal and illegal stocking, aquarium and pet releases, disposal of solid waste and wastewater, hull fouling, recreational fishing boats and equipment, and escapes from laboratories and ornamental plant nurseries. The current United States IAS management policies are drawn incrementally from across a wide range of environmental, natural resource, health and safety, and land use laws. The lack of a holistic federal statutory regime specifically designed to address the entirety of IAS issues has proven to be costly for the United States. Flaws in IAS policy are manifested through the United States' current regulatory approach. This Article argues that comprehensive reform is desirable and will produce more robust outcomes in the ongoing battle against biological invasions. This Article provides a descriptive analysis of major federal laws affecting IAS management in the United States and their deficiencies. This Article concludes with arguments in favor of a comprehensive federal IAS management reform.

I. INTRODUCTION

The term Invasive Alien Species (IAS) refers to plants, animals, pathogens, and other organisms introduced through anthropogenic activity into biogeographic areas outside of their historic range where they are likely to cause economic or environmental harm or adversely affect human health.[2] IAS pose a variety of risks to human well-being across the globe.[3] Rates of biological invasion are increasing rapidly and very few ecosystems remain free of IAS.[4] The United States federal regulatory approach to IAS management, characterized by an incremental patchwork of law and policy, has been insufficient to address the problem.[5]

IAS are considered invasive because they have "spread into areas away from sites of introduction . . . overcome barriers to dispersal within the new region and can cope with

1. *What are Invasive Alien Species*, CONVENTION ON BIOLOGICAL DIVERSITY, https://perma.cc/5UMY-L646 (archived Oct. 20, 2018).

2. *Id.*

3. *See* Liba Pejchar & Harold A. Mooney, *Invasive Species, Ecosystem Services and Human Well-Being*, 24 TRENDS ECOLOGY & EVOLUTION 497 (2009).

4. Hanno Seebens *et al.*, *Global Trade Will Accelerate Plant Invasions in Emerging Economies Under Climate Change*, 21 GLOBAL CHANGE BIOLOGY 4128, 4128 (2015); Petr Pyšek & David M. Richardson, *Invasive Species, Environmental Change and Management, and Health*, 35 ANN. REV. ENV'T & RESOURCES 25, 26 (2010).

5. M. LYNN CORN & RENÈE JOHNSON, CONG. RESEARCH SERV., R43258, INVASIVE SPECIES: MAJOR LAWS AND THE ROLE OF SELECTED FEDERAL AGENCIES 49-54 (2013).

the abiotic environment and biota in the general area."[6] Several characteristics are common among IAS, such as tolerance for a wide variety of habitat conditions, ability to reproduce and grow rapidly, ability to outcompete native species for resources (e.g. food, water, territory), and a lack of natural predators in the new ecosystem.[7]

IAS are environmentally problematic because they can negatively impact ecosystem processes, decrease native species abundance and richness, minimize overall genetic diversity, disturb the structure of natural communities, and can pose a direct threat to imperiled native species.[8] Loss of biodiversity is widely recognized as one of the greatest environmental concerns with IAS globally.[9] Evidence suggests IAS are a significant cause of extinction in native birds, fish, and mammals, and IAS are likely one of the top direct drivers of global biodiversity loss.[10] The major risk associated with IAS-driven loss of biodiversity is "ecosystems may be transformed into new configurations with unknown consequences for human welfare."[11]

IAS has a profound negative economic impact on ecosystem services, such as food, fuel, fiber, fresh water, medicine, pollination, climate regulation, erosion control, recreation, and cultural heritage.[12] Many species inflict multiple types of damages: for instance, zebra mussels can foul boat hulls, clog intake pipes, and bioaccumulate heavy metals poisoning other organisms in the food web.[13] Feral hogs destroy crops, pollute fresh water supplies, spread pathogens, and damage sites of cultural importance.[14] Economic losses and associated control costs from these, and the approximately 50,000 other IAS types in the United States are estimated in excess of $120 billion annually.[15] Furthermore, IAS include a number of known pathogens and pathogen-carrying vectors, and thus have important implications for human and animal health.[16] For example, invasive mosquitoes have regularly contributed to outbreaks of disease across the globe.[17]

Primary drivers of IAS in the Unites States include plant and pet imports.[18] Other significant drivers include habitat destruction, land use change, transportation pathways,

6. David M. Richardson et al., *Naturalization and Invasion of Alien Plants: Concepts and Definitions*, 6 DIVERSITY & DISTRIBUTIONS 93, 99 (2000).

7. Alexandra Freibott, *Invasive Species*, U.S. FOREST SERV., https://perma.cc/U69P-LE92 (archived Feb. 9, 2019).

8. Melodie A. McGeoch et al., *Global Indicators of Biological Invasion: Species Numbers, Biodiversity Impact, and Policy Responses*, 16 DIVERSITY & DISTRIBUTIONS 95, 96 (2010).

9. *See id*. at 95.

10. MILLENNIUM ECOSYSTEM ASSESSMENT, WORLD RESOURCES INST., ECOSYSTEMS AND HUMAN WELLBEING: BIODIVERSITY SYNTHESIS 49 (2005) https://perma.cc/LKE9-EDYL.

11. Charles Perrings, *The Economics of Biological Invasions*, 1 LAND USE & WATER RESOURCES RES. 1, 2 (2001).

12. Pejchar & Mooney, *supra* note 3, at 497.

13. *Id*. at 500.

14. *Id*. at 501.

15. David Pimentel et al., *Update on the Environmental and Economic Costs Associated with Alien-Invasive Species in the United States*, 52 ECOLOGICAL ECON. 273, 274 (2005).

16. Pejchar & Mooney, *supra* note 3, at 501; *see also* Peter T. Jenkins, *Invasive Animals and Wildlife Pathogens in the United States: The Economic Case for more Risk Assessment and Regulations*, 15 BIOLOGICAL INVASIONS 243, 243 (2013).

17. Steven A. Juliano & L. Philip Lounibos, *Ecology of Invasive Mosquitoes: Effects on Resident Species and on Human Health*, 8 ECOLOGY LETTERS 558, 568 (2005).

18. Regan Early et al., *Global Threats from Invasive Alien Species in the Twenty-First Century and National Response Capacities*, 7 NATURE COMM. 1, 1 (2016).

marine debris, ballast water discharges, aquaculture and importation of live foods, legal and illegal stocking, aquarium and pet releases, disposal of solid waste and wastewater, hull fouling, recreational fishing boats and equipment, and escapes from laboratories and ornamental plant nurseries.[19] Predictably, burgeoning global trade regimes threaten to exacerbate the rate of infestations and the extent of damage caused by IAS.[20] Additionally, climate change is expected to drastically increase the effects of both terrestrial and aquatic IAS.[21] The United States has relatively strong proactive and reactive capacities to handle problems caused by IAS but faces significant policy shortcomings in both areas.[22]

The flaws in IAS policy are manifested through the United States' current regulatory approach.[23] Rather than a holistic statutory regime specifically designed to address the entirety of IAS issues, legal authorities for IAS are drawn incrementally from across a wide range of environmental, natural resource, health and safety, and land use laws.[24] Despite the myriad of laws covering IAS and the vast number of regulatory bodies involved in IAS management,[25] no single, cohesive set of policies exist.[26] Gaps in policy coverage are widespread, and where coverage exists, it has been inadequate to prevent further introduction, establishment, and spread of IAS.[27] At the federal level, statutory law is aimed almost entirely at stopping importation of new organisms to the neglect of established populations. Other important areas lack coverage completely. For example, no agency has a mandate to prevent entry of infectious wildlife pathogens.[28] This oversight has proven costly. In the case of white-nose syndrome, an invasive fungus which causes the death of bats and thus loss of insect predation; the resulting agricultural pest problems have cost an estimated $3.7 billion annually.[29]

Our analysis focuses on the deficiencies in existing federal IAS law and policy. We argue comprehensive reform is desirable and will produce more robust outcomes in the ongoing struggle to control biological invasions. The following two sections of this report provide a descriptive analysis of major Federal laws affecting IAS management in the United States. The first section applies to general environmental laws that have implications for IAS, while the second section covers laws directly or expressly related to IAS. The third section presents arguments in favor of comprehensive federal IAS policy reform. A brief summary of minor and supplementary sources of Federal IAS law can be found in Appendix A. Appendix B outlines major agency responsibilities and selected

19. *Invasive Species, Methods of Introduction*, ALASKA DEP'T FISH & GAME, https://perma.cc/7GHZ-3TMX (archived Oct. 24, 2018).

20. *See* Philip E. Hulme, *Trade, Transport, and Trouble: Managing Invasive Species Pathways in an Era of Globalization*, 46 J. APPLIED ECOLOGY 10, 10 (2009).

21. Jessica J. Hellmann et al., *Five Potential Consequenses of Climate Change for Invasive Species*, 22 CONSERVATION BIOLOGY 534, 537 (2008); Frank J. Rahel & Julian D. Olden, *Assessing the Effects of Climate Change on Aquatic Invasive Species*, 22 CONSERVATION BIOLOGY 521, 523 (2008).

22. Early et al., *supra* note 18, at 4.

23. Daniel Simberloff et al., *Introduced Species Policy, Management, and Future Research Needs*, 3 FRONTIERS ECOLOGY & ENV'T 12, 12 (2005).

24. *Id.*

25. We refer to the term "IAS management" as a holistic program of pre- and post-invasion activities including prevention, detection, control, eradication, and restoration.

26. *See* Marc L. Miller, *The Paradox of U.S. Alien Species Law*, 35 ENVTL L. REP. 10179 (2005).

27. Andrea J. Fowler et al., *Failure of the Lacey Act to Protect U.S. Ecosystems Against Animal Invasions*, 5 FRONTIERS ECOLOGY & ENVIRONMENT 353, 357 (2007).

28. Jenkins, *supra* note 16, at 244

29. *Id.*

authorities. Additional IAS management information resources are available in Appendix C. This analysis does not cover international, regional, state, local or private IAS management authorities or responsibilities, although entities at these levels are often involved in or covered by the federal regulatory approach.

II. GENERAL FEDERAL ENVIRONMENTAL LAWS RELEVANT TO IAS MANAGEMENT

A. Clean Water Act / Clean Boating Act

Under the Clean Water Act (CWA), the United States Environmental Protection Agency (EPA) regulates the discharge of pollutants into waters of the United States.[30] One of the primary mechanisms for regulation under CWA is the National Pollutant Discharge Elimination System (NPDES) permitting program.[31] Ballast water, a direct pathway of unintentional introduction for IAS,[32] was originally exempt from NPDES regulations.[33] In 1999, several environmental advocacy groups petitioned EPA to repeal the ballast water exemption.[34] EPA denied the petition of review, the environmental groups filed suit, and EPA was eventually court-ordered to regulate ballast water releases under NPDES.[35] EPA subsequently issued the 2008 Vessel General Permit (VGP) which based ballast water requirements on narrative, as opposed to numerical standards; however, the VGP was challenged by environmental groups.[36] EPA settled, agreeing to re-issue a more stringent, numerically-based rule.[37] This resulted in the 2013 VGP, which attempted to regulate ballast water through technology-based effluent limitations, water quality-based effluent limitations, and monitoring and reporting requirements.[38] In 2015, the 2nd U.S. Circuit Court of Appeals, reviewing another petition from environmental groups, found the 2013 VGP to be "arbitrary and capricious" on a number of grounds and remanded the issue to EPA for further proceedings.[39] The 2013 VGP will remain in place while EPA works to issue a new VGP.[40]

Incidental discharges from recreational vessels are exempt from NPDES permitting requirements.[41] Instead, recreational vessels will eventually be regulated by the Clean Boating Act (CBA),[42] a 2008 amendment to the CWA, which "prohibits the operation of a recreational vessel or any discharge incidental to their normal operation in waters of the United States and waters of the contiguous zone (i.e. 12 miles into the ocean), unless the vessel owner or operator is using an applicable management practice meeting the EPA-

30. *See generally* 33 U.S.C. § 1251 (2018).
31. *See* 33 U.S.C. § 1342 (2018).
32. *See* 16 U.S.C. § 4701(a) (2018).
33. *See* 40 C.F.R. § 122.3(a) (2018).
34. Nat. Res. Def. Council v. EPA, 808 F.3d 556, 565 (2d Cir. 2015).
35. *Id*. at 562.
36. *Id*. at 566.
37. *Id*.
38. *Id*. at 567; *see also Vessels-VGP*, EPA, https://perma.cc/B2VK -5VU8 (archived Oct. 24, 2018).
39. EPA, 808 F.3d at 578.
40. *Id*. at 584.
41. 33 U.S.C. § 1342(r) (2018).
42. Clean Boating Act of 2008, Pub. L. No. 110-288 (2008).

developed performance standards."[43] However, CBA has yet to be fully integrated into CWA, and the responsible agencies are still undergoing a multi-phase implementation process.[44] A timeline for completion has not yet been released.

Under CBA, EPA has been directed to determine performance standards and management practices based in the following criteria: the nature of the discharge; the environmental effects of the discharge; the practicability of using a management practice; the effect of using management practices on the operation, operational capability, or safety of the vessel; applicable federal and state law; applicable international standards; and the economic costs of the use of the management practice.[45] Once the applicable determinations have been completed by the EPA, The United States Coast Guard (USCG) will promulgate and enforce vessel regulations based on class, type, size, and manufacture year.[46]

B. Endangered Species Act

The purpose of the Endangered Species Act (ESA)[47] is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions…" associated with the ESA.[48] ESA does not expressly regulate IAS; however, it implicitly provides statutory responsibility for federal IAS management activities affecting listed species and grants broad powers to the Departments of Commerce (DOC) and the Department of the Interior (DOI) to manage threatened and endangered species.[49] For example, section 7 of the ESA requires that Federal agencies engaged in IAS management "consult" with the appropriate body (i.e. 16 U.S.C. § 4701(a): the United States Fish and Wildlife Service or the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service, depending on the species) to "insure that any action authorized, funded, or carried out by [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…"[50] Under section 9, agency action leading to the "take"[51] of a listed species is prohibited,[52] subject to certain exceptions.[53] Executive Order 13112[54] expressly lists ESA, along with other pertinent statutes, as vesting authority in the Executive Branch to "prevent the introduction of invasive species and provide for their

43. *Development of Best Management Practices for Recreational Boats under Section 312(o) of the Clean Water Act*, OFFICE OF INFO. & REGULATORY AFFAIRS, https://perma.cc/8PAL-6w44 (archived Oct. 24, 2018) [hereinafter *Development of Best Management Practices*].

44. *About the Clean Boating Act*, EPA, https://perma.cc/5454-5DW8 (archived Oct. 24, 2018).

45. 33 U.S.C. § 1322(o)(2)(B)(i)-(vii) (2018).

46. 33 U.S.C. § 1322(o)(3).

47. 16 U.S.C. § 1531 (2018).

48. 16 U.S.C. § 1531(b).

49. *See generally* 16 U.S.C. § 1531-1543 (2018).

50. 16 U.S.C. § 1536(a)(2) (2018).

51. 16 U.S.C. § 1532(19) (2018) (defining the term "take" to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct).

52. 16 U.S.C. § 1538(a)(1)(A)-(C) (2018).

53. *See generally* 16 U.S.C. § 1539 (2018).

54. *See infra* Part II, Section E, subsection 3.

control and to minimize the economic, ecological, and human health impacts that invasive species cause."[55]

C. Federal Insecticide, Fungicide and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)[56] is the primary federal law regulating the distribution, sale, and use of pesticides. FIFRA thus affects IAS management practices related to chemical control[57] and requires Federal agencies to implement integrated pest management (IPM), which is defined as "a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."[58] Section 18 of FIFRA exempts state and federal agencies from the normal requirements when "emergency conditions exist which require such exemption."[59] Subject to EPA regulations,[60] detection of an IAS can qualify as an emergency condition if "no effective registered pesticides are available, no feasible alternative control methods are available, and the situation involves the introduction of a new pest, will cause economic loss, or will present significant risks to human health, endangered species, or the environment."[61]

D. National Environmental Policy Act

The National Environmental Policy Act (NEPA) is intended to "declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the eco- logical systems and natural resources important to the Nation; and to establish a Council on Environmental Quality…"[62] NEPA provides that:

> all agencies of the Federal Government shall include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on: (i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.[63]

55. Exec. Order No. 13112, 64 Fed. Reg. 6183 (1999).

56. *See generally* 7 *U.S.C.* § 136 (2018).

57. *Id.*

58. 7 U.S.C. § 136r-1 (2018).

59. 7 U.S.C. § 136(p) (2018).

60. 40 C.F.R. §§ 166.1 (2018).

61. U.S. ENVTL PROT. AGENCY, OVERVIEW OF EPA AUTHORITIES FOR NATURAL RESOURCES MANAGERS DEVELOPING AQUATIC INVASIVE SPECIES RAPID RESPONSE AND MANAGEMENT PLANS (2005).

62. National Environmental Policy Act of 1969, Pub. L. No. 91-190 § 2, 83 Stat. 852 (1970) (prior to 1975 amendments).

63. 42 U.S.C. § 4332(c)(i)-(v) (2018).

NEPA review has become a mostly procedural undertaking, meaning that NEPA does not generally require the Federal government take specific substantive actions in response to the findings of the review process.[64] Nonetheless, because NEPA applies to Federal actions "with effects that may be major and which are potentially subject to Federal control and responsibility,"[65] the Act has the potential to affect a broad range of IAS management decisions in which the Federal government participates.

E. Soil Conservation and Domestic Allotment Act

The Soil Conservation Act (SCA)[66] was enacted "to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public lands and relieve unemployment."[67] The National Resource Conservation Service (NRCS), formerly known as the Soil Conservation Service, was created under the SCA.[68] NRCS manages IAS in four primary ways:

> [1] Technical and financial assistance to manage invasive species and pests; [2] Conservation initiatives that work at a landscape scale to address natural resource concerns, including invasive species; [3] Conservation Innovation Grants with partner entities to support development and implementation of innovative approaches and strategies to address invasive species; and [4] Plant Materials Center research geared toward invasive species management and restoring areas where invasive species have been removed.[69]

Specific IAS management techniques employed by the NRCS include brush management, early successional habitat development and management, forest stand improvement, integrated pest management, prescribed burning, and prescribed grazing.[70]

III. FEDERAL ENVIRONMENTAL LAWS PROVIDING EXPRESS AUTHORITY FOR IAS MANAGEMENT

A. Animal Damage Control Act

The Animal Damage Control Act (ADCA)[71] establishes the U.S. Department of Agriculture's Wildlife Services[72] and allows for agency broad discretion to "take any action … necessary in conducting the program."[73] In recent decades, the scope of work by the Department of Agriculture (USDA) under ADCA has "expanded to include protecting human health and safety, natural resources, property, and threatened and endangered

64. *See* Matthew J. Lindstrom, *Procedures without Purpose: The Withering Away of the National Environmental Policy Act's Substantive Law*, 20 J. LAND RESOURCES & ENVTL. L. 245, 261 (2000).

65. 40 C.F.R. § 1508(18) (2018).

66. Soil Conservation & Domestic Allotment Act, Pub. L. No. 74-46, 49 Stat. 163 (1935).

67. *Id*.

68. *More Than 80 Year Helping People Help the Land: A Brief History of NRCS*, USDA, https://perma.cc/V3AP-CM36 (archived Feb. 2, 2019).

69. *Invasive Species and Pests*, USDA, https://perma.cc/YY7X-LRMG (archived Oct. 24, 2018).

70. *Id*.

71. 7 U.S.C. § 426 (2006).

72. Previously known as Animal Damage Control.

73. 7 U.S.C. § 8351 (2000).

species."[74] The methods employed by Wildlife Services to implement ACDA have been criticized for causing unnecessary suffering in target species, as well as producing unintended externalities to non-target species, human health, and the environment.[75] Nonetheless, USDA maintains broad regulatory authority under ACDA "with respect to injurious animal species", including IAS.[76] ACDA expressly grants USDA authority to control IAS, which serve as reservoirs for zoonotic disease.[77]

B. Cooperative Forestry Assistance Act

The Cooperative Forestry Assistance Act (CFAA)[78] was passed, in large part, to better integrate management of the nation's forests held in federal, state, local, and private ownership.[79] One of the primary purposes of CFAA is to prevent and control insects and diseases affecting non-Federal forest lands.[80] IAS control is expressly cited as a funding priority.[81] CFAA authorizes the United States Forest Service (USFS) to enter cooperative agreements with other Federal, state, and private entities to manage for IAS.[82] More specifically, the Act authorizes USFS to "conduct surveys to detect and appraise insect infestations and disease,"[83] and to "determine the biological, chemical, and mechanical measures necessary to prevent, retard, control, or suppress incipient, potential, threatening, or emergency insect infestations and disease conditions affecting trees."[84] CFAA also establishes a number of programs to provide educational resources,[85] technical assistance,[86] land stewardship guidance,[87] and financial support (including a "Pest and Disease Revolving Loan Fund"),[88] and establishes the Forest Resource Coordinating Committee "to coordinate nonindustrial private forestry activities" between USFS and private landowners.[89]

74. MARK E. TOBIN, U.S. DEP'T OF AGRIC., U.S. DEPARTMENT OF AGRICULTURE WILDLIFE SERVICE: PROVIDING FEDERAL LEADERSHIP IN MANAGING CONFLICTS WITH WILDLIFE (2012), https://perma.cc/G4CC-ES9E (archived Oct. 24, 2018).

75. *See* Tiffany Bacon, *The Implementation of the Animal Damage Control Act: A Comment on Wildlife Services's Methods of Predatory Animal Control*, 32 J. NAT'L ASS'N ADMIN. L. JUDICIARY 361, 371-76 (2012); THE HUMANE SOCIETY OF THE UNITED STATES, WILDLIFE DISSERVICE: The USDA WILDLIFE SERVICES' INEFFICIENT AND INHUMANE WILDLIFE DAMAGE MANAGEMENT PROGRAM 2, https://perma.cc/J32S-YS77 (archived Oct. 24, 2018).

76. Bacon, *supra* note 75, at 366.

77. 7 U.S.C. § 8353 (2018).

78. *See generally* 16 U.S.C. § 2101 (2018).

79. 16 U.S.C. § 2101(a)(1).

80. 16 U.S.C. § 2101(b)(3).

81. 16 U.S.C. § 2101(c)(2).

82. 16 U.S.C. § 2104(a) (2018).

83. 16 U.S.C. § 2104(b)(1).

84. 16 U.S.C. § 2104(b)(2).

85. 16 U.S.C. § 2102(a) (2018); 16 U.S.C. § 2105(b)(3) (2018).

86. 16 U.S.C. § 2107(a) (2018).

87. 16 U.S.C. § 2103(a) (2018).

88. 16 U.S.C. § 2104(b) (2018).

89. 16 U.S.C. § 2113(a)(1) (2018).

C. Executive Order 13112

One of the most important pieces of the current Federal IAS regulatory scheme is Executive Order 13112 (EO 13112),[90] which is reprinted as Appendix D below. Unlike the other laws listed here, which are acts of Congress, EO 13112 is a legally binding directive issued by the President to federal agencies.[91] EO 13112 mandates that all federal agencies coordinate a response to the threats posed by IAS,[92] and establishes the National Invasive Species Council (NISC) as the primary federal mechanism for that coordination.[93] NISC is responsible for general oversight of EO 13112 activities and is directed to supervise the thirty-five federal agencies which engage in IAS management, ensuring that all agency activities concerning invasive species are "coordinated, complementary, cost-efficient, and effective."[94] NISC is also mandated to:

> encourage planning and action at local, tribal, state, regional, and ecosystem-based levels…in cooperation with stakeholders and existing organizations addressing invasive species . . .; develop recommendations for international cooperation in addressing invasive species; develop, in consultation with the Council on Environmental Quality [(CEQ)],[95] guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species…; facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health; [and] facilitate establishment of a coordinated, up-to-date information-sharing system … and exchange of information concerning invasive species.[96]

Other NISC functions include drafting the Interdepartmental Invasive Species Performance Budget[97] and working with the State Department to "seek ideas and advice for standards."[98]

EO 13112 further directs NISC to draft the National Invasive Species Management Plan (NISMP), in order to "detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species."[99] NISC is required to update the NISMP biennially, and to concurrently evaluate and report on success in achieving the NISMP's various goals and objectives.[100] These requirements have only been partially satisfied, as NISC has issued just three NISMPs in the preceding seventeen years.[101]

The first NISMP, released in 2001, provides a broad action plan for IAS management in the areas of leadership and coordination, prevention, early detection and rapid response,

90. Exec. Order No. 13112, 64 Fed. Reg. 6183 (Feb. 8, 1999)

91. *See generally Executive Order*, WEST'S ENCYCLOPEDIA OF AMERICAN LAW (2d ed. 2005).

92. *See* 64 Fed. Reg. at 6184.

93. *Id*. at 6183.

94. *Id*. at 6184.

95. *Id*. (A division of the Executive Office created by the National Environmental Policy Act).

96. *Id*.

97. CHUCK BARGERON, ABCS OF INVASIVE SPECIES ORGANIZATIONS (2018), https://perma.cc/WJ84-XUBW.

98. *National Invasive Species Council*, U.S. DEP'T INTERIOR, https://perma.cc/3W8T-95KE (archived Oct. 24, 2018).

99. 64 Fed. Reg. at 6184.

100. *Id*.

101. *National Invasive Species Council*, *supra* note 98.

control and management, restoration, international cooperation, research, information management, education and public awareness.[102] The second NISMP, released in 2008 to cover the period through 2012, consists of a more specific set of visions and objectives within a hierarchical structure, including strategic goals, a strategic action plan for each strategic goal, implementation tasks, performance elements, identified agency lead(s), and named participants.[103] Some important improvements have been made to the most recent version of the NISMP, which was adopted in July 2016.[104] For example, the Plan has been further refined and focused on a set of "Priority Actions" (i.e. provide institutional leadership and set priorities, facilitate effective coordination and cost-efficiencies, raise awareness and motivate high-impact actions, remove barriers, assess and strengthen federal capacities, and foster innovation) with a strategic structure aimed to guide NISC from goal to need to action.[105] IAS management efforts have also been regrouped around the following four approaches associated with different stages of invasion: "prevention (keep invasive species from entering a new ecosystem), eradication (remove the entire population of a non-native species), control (contain or otherwise manage the population of an invasive species so as to minimize spread and impacts), and ecosystem restoration (recover native species and ecosystems post-removal of invasive species in order to build resistance and resilience to future introductions of non-native species)".[106] Implementation responsibilities have been reorganized and expressly defined, and the new NISMP includes a timeline for goal completion.[107]

D. Federal Noxious Weed Act

The Federal Noxious Weed Act (FNWA)[108] was an important early attempt to codify invasive species law, which is now largely superseded by the passage of the Plant Protection Act.[109] However, United States Code Section 2814 remains intact and requires each Federal agency to:

> (1) designate an office or person adequately trained in the management of undesirable plant species to develop and coordinate an undesirable plants management program for control of undesirable plants on Federal lands under the agency's jurisdiction; (2) establish and adequately fund an undesirable plants management program through the agency's budgetary process; (3) complete and implement cooperative agreements with State agencies regarding the management of undesirable plant species on Federal lands under the agency's jurisdiction; and (4) establish integrated management systems to control or contain undesirable plant species targeted under cooperative agreements.[110]

102. *See generally* DEP'T INTERIOR, NATIONAL INVASIVE SPECIES COUNCIL, MEETING THE INVASIVE SPECIES CHALLENGE: MANAGEMENT PLAN 2001 (2001), https://perma.cc/6AVL-HMM9.

103. 2008-2012 NATIONAL INVASIVE SPECIES MANAGEMENT PLAN, THE NAT'L INVASIVE SPECIES COUNCIL 5 (2008), https://perma.cc/QA4V-5MR9.

104. *See* MANAGEMENT PLAN 2016-2018, NAT'L INVASIVE SPECIES COUNCIL (2016), https://perma.cc/D2BL-AB9H.

105. *Id*. at 1.

106. *Id*. at 5.

107. *Id*. at 21.

108. *See generally* The Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801 (repealed 2000).

109. *See infra* Part III Section i.

110. 7 U.S.C. § 2814(a)(1)-(4) (2018).

U.S.C. Section 2814(c) further states: "Federal agencies, as appropriate, shall enter into cooperative agreements with State agencies to coordinate the management of undesirable plant species on Federal lands,"[111] and sets forth specific cooperative plan requirements.[112] Section 2814(f) directs USDA and DOI "to coordinate Federal agency programs for control, research, and educational efforts associated with Federal, State, and locally designated noxious weeds."[113]

E. Federal Seed Act

The Federal Seed Act (FSA)[114] regulates seed movement in commerce and acts as another potential barrier against the importation and cross-boundary movement of IAS.The FSA mandates that all agricultural seeds moving through interstate commerce must be clearly labeled, and the importation and movement of adulterated or mislabeled seeds is prohibited.[115] The USDA's Agricultural Marketing Service (AMS) is responsible for enforcing FSA's interstate commerce provisions.[116] The FSA also regulates seed importation into the United States.[117] The Animal and Plant Health Inspection Service (APHIS) is the lead agency for the international provisions, which expressly prohibit the importation of noxious-weed seeds.[118] Shipments not in compliance with the FSA are subject to seizure,[119] as well as civil and criminal penalties.[120]

F. International Forestry Cooperation Act / Hawaii Tropical Forest Recovery Act

The purpose of International Forestry Cooperation Act (IFCA),[121] is to provide assistance "that promotes sustainable development and global environmental stability, including … prevention and control of insects, diseases, and other damaging agents."[122] IFCA provides authority for international forestry activities that relate to IAS management, including:

> Shar[ing] technical, managerial, extension, and administrative skills related to public and private natural resource administration; provid[ing] education and training opportunities to promote the transfer and utilization of scientific information and technologies; engag[ing] in scientific exchange and cooperative research with foreign governmental, educational, technical and research institutions; and cooperating with domestic and international organizations that further international programs for the management and protection of forests, rangelands, wildlife and fisheries, and related natural resource activities.[123]

111. 7 U.S.C. § 2814(c)(1).
112. 7 U.S.C. § 2814(c)(2)(A)-(C).
113. 7 U.S.C. § 2814(f)(1).
114. 7 U.S.C. § 1551 (2018).
115. 7 U.S.C. § 1571(a) (2018).
116. *Federal Seed Act*, USDA, https://perma.cc/8W2T-TFWD (archived Jan 2, 2019).
117. 7 U.S.C. § 1581 (2018).
118. 7 U.S.C. § 1581(1).
119. 7 U.S.C. § 1595 (2018).
120. 7 U.S.C. § 1596(a)-(b).
121. Pub. L. No. 101-513, 104 Stat. 1980 (1990); 16 U.S.C. § 4501 (2018).
122. 16 U.S.C. § 4501(b)(1)(D),
123. 16 U.S.C. § 4501(b)(2)-(5).

Under IFCA, USFS "delivers invasive species research and development products for vegetation management and protection; wildlife, fish, water and air sciences; resource valuation and use; and inventory and monitoring," as well as conducting IAS prevention, rapid response, control, management, and restoration activities.[124]

IFCA was amended in 1992 by the Hawaii Tropical Forest Recovery Act (HTFRA),[125] which states in part that Hawaii is "an area of special conservation concern … as the most remote archipelago in the world, its ecosystems are quite small and thus are highly vulnerable to disruption by introduced species."[126] HTFRA expressly authorizes USFS to provide assistance, including grants contracts, and cooperative agreements,[127] to eligible entities in order to:

> "protect indigenous plant and animal species and essential watersheds from non-native animals, plants, and pathogens;[128] […] establish biological control agents for non-native species that threaten natural ecosystems;[129] […] establish a monitoring system in tropical forests to identify baseline conditions and determine detrimental changes or improvements over time;[130] [and] detect and appraise stresses affecting tropical forests caused by insect infestations, diseases, pollution, fire, and non-native animal and plant species, and by the influence of people."[131]

USFS and the State of Hawaii's Board of Land and Natural Resources maintain a cooperative agreement to accomplish the directives under IFCA and HTFRA.[132]

G. Lacey Act

The Lacey Act[133] contains two major sections, both of which are used to manage the threats posed by IAS. The first section of the Lacey Act authorizes DOI to designate species as "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States…"[134] In turn, species designated as injurious by the Secretary are subject to a range of importation and shipping restrictions.[135] Listed species can only be imported into the United States, or transported between states,

124. *Invasive Species Program Policy and Authorities*, U.S. FOREST SERV., https://perma.cc/65T2-KXW7 (archived Feb. 2, 2019).

125. Hawaii Tropical Forest Recovery Act, Pub. L. No. 102-574, 106 Stat. 4593 (1992); 16 U.S.C. § 4503a (2018).

126. K.D. Warner & F. Kinslow, *Manipulating Risk Communication: Value Predispositions Shape Public Understandings of Invasive Species Science in Hawaii*, 22 PUB. UNDERSTANDING OF SCI. 1, 3 (2011).

127. 16 U.S.C. § 4502a(b) (2018); Hawaii Tropical Forest Recovery Act § 2(d)(1)(B) (1992).

128. 16 U.S.C. § 4502a(a)(3); Hawaii Tropical Forest Recovery Act § 3(a)(3).

129. 16 U.S.C. § 4502a(a)(4); Hawaii Tropical Forest Recovery Act § 3(a)(4).

130. 16 U.S.C. § 4502a(a)(5).

131. 16 U.S.C. § 4502a(a)(6).

132. *See generally* U.S. FOREST SERV., COOPERATIVE AGREEMENT BETWEEN THE UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE AND THE STATE OF HAWAII BOARD OF LAND AND NATURAL RESOURCES (December 8, 2006), https://perma.cc/S3JB-8JUE.

133. *See generally* 18 U.S.C. §§ 42-43 (2018); 16 U.S.C. §§ 3371-3378 (2018).

134. 18 U.S.C. § 42(a)(1) (2018).

135. 50 C.F.R. § 16.11(a) (2018).

if a permit has been obtained from the United States Fish and Wildlife Service (FWS).[136] Procedurally, FWS must propose a formal rule to add any species to the injurious list, followed by notice and comment procedures pursuant to the Administrative Procedure Act.[137] In addition to the standard rulemaking process implemented by FWS, species have been added to the injurious species list by federal statute.[138]

The process of adding a species to the list of prohibited species under the Lacey Act has been described as "tedious,"[139] and research indicates that, on average, it takes more than four years to add a species to the list.[140] According to FWS, one reason for the length of this process is that NEPA requires Federal agencies to "consider the potential environmental impact of agency actions prior to implementation."[141] This process requires agencies to "prepare either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS)" the preparation of which is highly time-consuming.[142] In the interest of addressing invasive threats as expediently as possible, FWS is currently seeking a "categorical exclusion" which would permit the addition of species to the injurious list without the completion of an EA or EIS if the agency can show a significant risk that a species will have an individual or cumulative effect on human health or the environment.[143]

While the first section of the Lacey Act prohibits transportation of specific species on the injurious wildlife list, the second section, also known as "the Other Lacey Act," prohibits the importation, exportation, transportation, sale, or purchase of any organism which would violate any law, treaty, or regulation of the United States or any foreign law.[144] This part of the Lacey Act requires any person importing a plant to file a declaration that contains the specific scientific name of the plant, a description of the value and quantity of the plant in question, and the name of the country from which the plant was taken.[145] This part of the Act also effectively adopts the prohibitions imposed by any foreign government as it relates to the transportation of any organisms (including IAS) being exported from that nation.[146] Thus, violation of any foreign law governing transportation of IAS in such a case carries the potential to become a violation of United States Federal law and is therefore subject to civil and criminal penalties.[147]

H. Nonindigenous Aquatic Nuisance and Control Act / National Invasive Species Act

The impetus for passing the Nonindigenous Aquatic Nuisance and Control Act (NANCA),[148] as well as for its re-authorization and expansion through the National Invasive

136. 50 C.F.R. § 16.22 (2018).

137. *See generally* 5 U.S.C. §§ 551-59 (2018).

138. See, e.g., Asian Carp Prevention and Control Act, Pub. L. No. 111-307, 124 Stat. 3282 (2010).

139. *See generally* Jim Graham et al., *Vision of a Cyberinfrastructure for Nonnative, Invasive Species Management*, 58 BIOSCIENCE 263 (2008).

140. *See* Fowler, supra note 27, at 357.

141. U.S. FISH & WILDLIFE SERV., CATEGORICAL EXCLUSION FOR LISTING SPECIES AS INJURIOUS WILDLIFE 1, https://perma.cc/MFJ2-CALC (archived Oc. 24, 2018).

142. *Id*.

143. *Id*. at 1-2.

144. 16 U.S.C. § 3372(a) (2018).

145. 16 U.S.C. § 3372(f).

146. 16 U.S.C. § 3372(a)(1).

147. 16 U.S.C. § 3373(a), (d) (2018).

148. *See generally* 16 U.S.C. §§ 4701-02 (2018).

Species Act (NISA),[149] was to limit the spread of IAS through ballast water. The express purposes of these Acts are "(1) to prevent unintentional introduction and dispersal of nonindigenous species into waters of the United States through ballast water management and other requirements; (2) to coordinate federally conducted, funded or authorized research, prevention, control, information dissemination and other activities regarding … aquatic nuisance species; (3) to develop and carry out environmentally sound control methods to prevent, monitor and control unintentional introductions of nonindigenous species from pathways other than ballast water exchange; (4) to understand and minimize economic and ecological impacts of nonindigenous aquatic nuisance species that become established…"[150] NANCA/NISA establishes several research programs and studies, authorizes regional grant funds, encourages international cooperation, and creates a national ballast information clearinghouse managed by the Smithsonian Environmental Research Center.[151] None of the provisions in NANCA/NISA "supersede any requirements or prohibitions pertaining to the discharge of ballast water" under the CWA,[152] and the Act expressly allows state governments to enact alternative ballast water standards, so long as those requirements are least as rigorous as Federal standards.[153] NANCA/NISA also directs USCG[154] and the Department of Defense[155] to implement ballast water management programs for each agency's own seagoing vessels, "subject to operational conditions."

NANCA/NISA established the Aquatic Nuisance Species Task Force, with membership consisting of representatives from USCG, FWS, NOAA, EPA, United States Army Corps of Engineers (USACE), the State Department, APHIS, Regional Water Basin Authorities, and state government.[156] Major components of the Task Force's work include prevention, control, monitoring, research, education, and technical assistance.[157] The Task Force "encourages state and interstate planning entities to develop management plans describing detection and monitoring efforts of aquatic nuisance species, prevention efforts to stop their introduction and spread, and control efforts to reduce their impacts."[158] To date, forty state plans and three interstate plans have been approved.[159] The Task Force also maintains a publicly-accessible database of contact information for invasive species experts organized by geographic area and subject matter.[160]

Agency ballast water management rules promulgated under NANCA/NISA are enforced by USCG and are applicable to "all non-recreational vessels, U.S. and foreign, that are equipped with ballast tanks and operate in the waters of the United States,"[161] subject

149. 16 U.S.C. §§ 4701 (2018); National Invasive Species Act of 1996, Pub. L. No. 104-332 (1996).
150. 16 U.S.C. § 4701(b)(1)-(4).
151. 16 U.S.C. § 4712(e)-(f) (2018).
152. 16 U.S.C. § 4711(b)(2)(C) (2018).
153. 16 U.S.C. § 4725 (2018).
154. 16 U.S.C. § 4713(b) (2018).
155. 16 U.S.C. § 4713(a).
156. 16 U.S.C. § 4721(b) (2018).
157. *State ANS Management Plans,* ANS TASK FORCE, https://perma.cc/ZPJ7-NLEU (archived Oct. 24, 2018).
158. *Id*.
159. *Id*.
160. *Id*.
161. 33 C.F.R § 151.2010 (2018).

to certain exemptions.[162] A specific subset of regulations has been created for the Great Lakes and the Hudson River[163] - regions which have been particularly hard hit by aquatic IAS.[164] Appropriate ballast water management methods include installing a USCG-approve ballast water management system, using ballast procured solely from a U.S. public water system, performing ballast water exchanges at least two-hundred miles from shore, refraining completely from discharging ballast into the waters of the U.S., or discharging to an on-shore or vessel-based treatment facility.[165] Vessel operators subject to NANCA/NISA must comply with a variety of reporting requirements.[166]

I. Plant Protection Act / Noxious Weed Control and Eradication Act

The Plant Protection Act (PPA),[167] which superseded and consolidated the Plant Quarantine Act, Federal Plant Pest Act, Federal Noxious Weed Act, and other IAS-related legal authorities, is based on Congressional findings that IAS management is "necessary for the protection of the agriculture, environment, and economy of the United States."[168] PPA authorizes USDA to restrict or prohibit the importation, exportation, and interstate movement of plant pests and noxious weeds[169] and to issue permits to prevent the introduction or dissemination of such species.[170] The Act expressly mandates that regulations developed under PPA are "based on sound science and are transparent and accessible."[171] Another important provision authorizes USDA to publish a Federal Noxious Weeds List designating species which are "prohibited or restricted from entering the United States or that are subject to restrictions on interstate movement within the United States."[172] The current list is reprinted below as Appendix E.

PPA provides the primary authority for much of the USDA's IAS preventative quarantine efforts; it specifically authorizes USDA to "seize, quarantine, treat . . . destroy, or otherwise dispose of" any plant pest or noxious weed traveling through interstate or foreign commerce.[173] However, the USDA must apply the least drastic action available to eliminate the possible threat.[174] PPA further prohibits movement of any "plant, plant product, biological control organism, plant pest, or noxious weed" from its port of entry (1) until inspection has occurred or (2) release has been otherwise authorized.[175] Parties responsible for such material are required to obtain a permit from USDA[176] and must provide

162. *See generally* 33 C.F.R § 151.2015-20 (2018).
163. *See generally* 33 C.F.R. §151.1500-1518 (2018).
164. *See generally* Kristen T. Holeck *et al*., *Bridging Troubled Waters: Biological Invasions, Transoceanic Shipping, and the Laurentian Great Lakes*, 54 BIOSCIENCE 919 (2004).
165. 33 C.F.R. § 151.2025(a)(1)-(3) (2018).
166. *See* 33 C.F.R. § 151.2025(g) (2018).
167. 7 U.S.C. §§ 7701-02 (2018).
168. 7 U.S.C. § 7701(a)(1) (2018).
169. 7 U.S.C. § 7712(a) (2018).
170. 7 U.S.C. § 7711(a) (2018).
171. 7 U.S.C. § 7712(b).
172. 7 U.S.C. § 7712(f)(1).
173. 7 U.S.C. § 7714(a) (2018).
174. 7 U.S.C. § 7714(d).
175. 7 U.S.C. § 7713(a)(2) (2018).
176. 7 U.S.C. § 7713(b)(1).

the name and address of consignee, the nature and quantity of the material being transported, and the country or locality in which it was produced.[177]

PPA expressly directs USDA to engage state agriculture departments in IAS early detection and rapid response programs,[178] and to establish a "National Clean Plant Network" of centers for diagnostic and pathogen elimination services.[179] APHIS regulations under PPA require that plant pests which are being imported into the United States must enter through certain ports[180] and provide that inspectors may seize certain cargo in the event that the inspector "considers [the cargo] may be infested or infected by or contain a plant pest."[181] APHIS inspectors have authority to seal cargo to prevent dissemination of plant pests[182] and may take "emergency measures" in the event a new or emerging IAS is discovered in a shipment.[183]

The Noxious Weed Control and Eradication Act (NWCEA),[184] a 2004 amendment to PPA, directs USDA (through APHIS) to provide financial and technical assistance to weed management entities engaged in noxious weed control and eradication efforts on both Federal and non-Federal lands.[185] Funding priorities are based on the following criteria:

> (1) the severity of the noxious weed problem or potential problem addressed by the project; (2) the likelihood that the project will prevent or resolve the problem, or increase knowledge about resolving similar problems[;] (3) The extent to which the Federal funds will leverage non-Federal funds …[;] (4) The extent to which the program will improve the overall capacity of the United States to address noxious weed control and management[;] (5) The extent to which the weed management entity has made progress in addressing noxious weed problems[;] (6) The extent to which the project will provide a comprehensive approach to the control or eradication of noxious weeds[;] (7) The extent to which the project will reduce the total population of noxious weeds[;] (8) The extent to which the project promotes cooperation and participation between States that have common interests in controlling and eradicating noxious weeds[; and] (9) Other factors that the Secretary determines to be relevant.[186]

States may request APHIS assistance for rapid response to IAS outbreaks if the following criteria are met: (1) "there is a demonstrated need for assistance," (2) the IAS is considered a significant threat to native fish and wildlife habitat, (3) the economic impact of delay would be substantial, and (4) there is a technically feasible, economically responsible, and ecologically sound response.[187]

177. 7 U.S.C. § 7713(b)(3)(A)-(C).
178. 7 U.S.C. § 7721(b) (2018).
179. 7 U.S.C. § 7721(e)(1)-(2).
180. 7 C.F.R. § 330.104 (2019).
181. 7 C.F.R. § 330.105.
182. 7 C.F.R. § 330.110.
183. *See* 7 C.F.R. § 330.106.
184. 7 U.S.C. § 7781 (2018).
185. 7 U.S.C. § 7782(a) (2018).
186. 7 U.S.C. § 7783(f)(1)-(9) (2018).
187. 7 U.S.C. § 7784(f) (2018).

IV. INCREMENTAL APPROACHES AND THE NEED FOR COMPREHENSIVE REFORM

The field of invasion science, which draws upon frameworks and methodologies from a range of distinct disciplines including biogeography, conservation biology, history, epidemiology, ecology, and others has produced a large base of experimental and theoretical knowledge. Previous studies have advanced our understanding of the processes and the problems associated with IAS. At the same time, Federal resource management agencies have placed IAS management at the highest level of organizational importance. Yet, these efforts have not translated to effective, wide-spread, and collaborative efforts on the ground. Profound challenges remain, and the incremental Federal approach to IAS management is at the root of many of these challenges. It is critical to develop legal and policy solutions which maximize effectiveness, cost-efficiency, collaboration, participation, and democratic outcomes. Comprehensive reform is a practical and appropriate strategy to accomplish those goals, showing promise for improvements in the control of IAS. This includes prioritization of resources, evidence-based decision-making, stakeholder engagement, and agency coordination and accountability.

A. Prioritization of Resources

Cost-effective IAS management involves a combination of strategies across the spectrum of prevention, detection, control, eradication, and restoration.[188] In some cases it may be more cost-effective to prevent invasions than to control populations once established.[189] In other situations, prevention may be impossible or nearly impossible given associated costs, making early detection and control a more feasible option.[190] IAS managers must therefore maintain disciplined, efficient use of economic inputs to minimize the impacts and cost of IAS.[191] However, even the best managers cannot operate effectively without sufficient resources in terms of funding and trained personnel. Chronic lack of essential assets remains a fundamental problem with the incremental implementation of Federal IAS policy. Managers are often forced to expend limited funds and personnel in response to immediate threats, leaving few resources available for implementation of long-term strategic planning.[192] Priorities are neglected because of inadequate resource allocation. For example, "the intense monitoring as it would be necessary to build comprehensive and up-to-date databases, rarely occurs due to resource limitations, such as the availability of funding and personnel".[193]

The current incremental approach to IAS management has done a poor job of channeling appropriate resources to management entities. Comprehensive IAS reform represents the opportunity to allocate resources more optimally. For example, within management agencies, comprehensive reform could be structured to mandate risk

188. Shefali V. Mehta et al., *Optimal Detection and Control Strategies for Invasive Species Management*, 61 ECOLOGICAL ECON. 237, 238 (2007).

189. *See* Brian Leung et al., *An Ounce of Prevention or a Pound of Cure: Bioeconomic Risk Analysis of Invasive Species*, 269 PROC. ROYAL SOC'Y: B2407 (2002).

190. Mehta et al., supra note 188, at 243.

191. Hiroyuki Yokomizo et al., *Managing the Impact of Invasive Species: The Value of Knowing the Density-Impact Curve*, 19 ECOLOGICAL APPLICATIONS 376, 377 (2009).

192. Diane L. Larson et al., *A Framework for Sustainable Invasive Species Management: Environmental, Social, and Economic Objectives*, 92 J. ENVTL. MGMT. 14, 14 (2011).

193. David G. Delaney et al., *Marine Invasive Species: Validation of Citizen Science and Implications for National Monitoring Networks* 10 BIOLOGICAL INVASIONS 117, 118 (2008).

assessment, which is a systematic method for characterizing the likelihood and severity of environmental hazards. Adoption of risk assessment technologies under the current regime has been slow due to cost concerns; however, recent research has shown even simple prescreening risk assessment is capable of producing positive net economic benefits.[194] Risk assessment presents a scientific mechanism for answering questions about the optimal allocation of scarce resources.[195] The ultimate goal of risk assessment is to "maximize welfare, where welfare can be a function of both market and non-market values,"[196] including economic value gained through management activities, the costs of delay or inaction, spatial and temporal concerns, and damage to non-market commodities (e.g. ecosystem services).[197]

An additional benefit of risk assessment is the ability to craft a more proactive IAS policy. In order to be effective, IAS management must be streamlined enough to compete with the pace of biological invasions; this has not generally been the case in the United States. Much of the literature on IAS policy reform has been dedicated to discussions on how to make management activities more proactive. Risk assessment offers a proactive alternative which can account for economic and ecological changes over time,[198] be suited to the integration of adaptive management techniques,[199] and cater to the holistic nature of IAS management by considering the entire suite of agency activities (i.e. prevention, detection, control, eradication, and restoration).[200] Several international examples have shown the benefits of risk assessment (i.e. reduced time, increased coverage, greater flexibility) are clearly attainable,[201] and the costs of analysis can be significantly offset by shifting the economic burden via user-paid fees from sectors wishing to import potential IAS.[202] The basic infrastructure for a fee-generating inspection system already exists under Federal law and is codified at 50 C.F.R. §§14.91-94.

B. Evidence-Based Decision-Making

Despite some remaining gaps, researchers have developed a wide range of new, evidence-based management frameworks (i.e., based on risk assessment, bioeconomic modeling) for IAS.[203] This is good news as evidence-based approaches routinely outperform efforts based solely on expert opinion (i.e. managerial discretion)[204] and fresh technologies

194. Rueben P. Keller *et al.*, *Risk Assessment for Invasive Species Produces Net Bioeconomic Benefits*, 104 PROC. NAT'L ACAD. SCI. 203, 203 (2007).

195. Mark C. Andersen *et al.*, *Risk Assessment for Invasive Species*, 24 RISK ANALYSIS 787, 789 (2004).

196. *See* Leung et al., *supra* note 189, at 2408.

197. Larson et al., *supra* note 192, at 17.

198. Leung et al., *supra* note 189, at 2408.

199. Glenn W. Suter II, *Ecological Risk Assessment* 20 (2d ed. 2007).

200. *See* DEP'T INTERIOR, NATIONAL INVASIVE SPECIES COUNCIL, MEETING THE INVASIVE SPECIES CHALLENGE: MANAGEMENT PLAN 2001 (2001), https://perma.cc/6AVL-HMM9.

201. *See* Jenkins, *supra* note 16, at 245.

202. *See* Peter T. Jenkins, *Paying for Protection from Invasive Species*, 19 Issues Sci. & Tech. 67 (2002).

203. *See*, e.g., David Drolet *et al.*, *Evidence-Based Tool Surpasses Expert Opinion in Predicting Probability of Eradication of Aquatic Nonindigenous Species* 25 ECOLOGICAL APPLICATIONS 441 (2015).

204. *See id.*

are needed for the development of a proactive, adaptable IAS policy regime. Comprehensive reform presents the opportunity to prioritize evidence-based decision-making by requiring, amongst other things, the development of relevant decision-making indicators, interactive monitoring and evaluating decisions, improved forecasting methodologies, and planning for environmental justice.[205] Other fundamental questions which need to be expressly addressed are what type of knowledge should be transferred, in what form, to whom, and how.[206] Perhaps most importantly, there is a definitive need to reconcile, in a way that strengthens the impact of applied science on law and policy, the gap between the broad types of questions typically posed during policy formation and the reductionist hypotheses susceptible to scientific inquiry.[207] Fortunately, a well-developed body of literature already exists in the area of evidence-based environmental management, with real-world models from which to draw pragmatic instruction.[208]

Furthermore, evidence-based management requires, at the very least, taxonomic, geospatial, and temporal data.[209] Therefore, high-quality, accurate, standardized datasets are another essential prerequisite for evidence-based management.[210] Unfortunately, current IAS databases can generally be described as "disjunct, disparate, incomplete, and often out-dated"[211] much like the incremental set of laws under which they are managed. The uncertainties associated with lack of reliable data pose challenges to evidence-driven management efforts of all sorts.[212] In other words, new methodologies have been less consequential than they could be with a corresponding increase in the reliability of model data.[213]

One of the most important functions of comprehesive reform should be the creation of a publically-accessable, realtime "cyberinfrastructure" for IAS management providing at least the following five major functions: (1) collect and share biogeographic and temporal data on IAS; (2) issue warnings for likely invaders by location; (3) send early detection alerts to stakeholders; (4) model current and potential ranges for specific vectors; and (5) provide information on best-management practices and restoration efforts.[214] Data collectors, particularly for smaller projects, should be encouraged to expand data sharing efforts through mergers with organizations which have the resources to expand and maintain online data management systems.[215] Historically underutilized sources of data, for example, collected from biological control organisms, horticultural introductions, and

205. THE NAT'L ACADEMIES OF SCI., DECISION MAKING FOR THE ENVIRONMENT: SOCIAL AND BEHAVIORAL SCIENCE RESEARCH PRIORITIES 86 (Garry D. Brewer & Paul C. Stern eds., 2005).

206. John N. Lavis *et al.*, *How Can research Organizations More Effectively Transfer Research Knowledge to Decision Makers?* 81 MILBANK Q. 221, 222 (2003).

207. *See* Andrew S. Pullin *et al.*, *Linking Reductionist Science and Holistic Policy Using Systematic Reviews: Unpacking Environmental Policy Questions to Construct an Evidence-Based Framework*, 46 J. APPLIED ECOLOGY 970, 970 (2009).

208. *See, e.g.,* Jenkins, *supra* note 16, at 245.

209. Thomas J. Stohlgren & John L. Schnase, *Risk Analysis for Biological Hazards: What We Need to Know About Invasive Species*, 26 RISK ANALYSIS 163, 168 (2006).

210. *See id.*

211. Delaney et al., *supra* note 193, at 118.

212. *See* David M. Lodge & Kristin Shrader-Frechette, *Nonindigenous Species: Ecological Explanation, Environmental Ethics, and Public Policy*, 17 CONSERVATION BIOLOGY 31, 36 (2003).

213. *See id.*

214. Graham et al., *supra* note 139, at 263.

215. Alycia W. Crall et al., *Improving and Integrating Data on Invasive Species Collected by Citizen Scientists*, 12 BIOLOGICAL INVASIONS 3419, 3420 (2010).

natural history collections can "provide insights into evolutionary processes associated with invasion success," and are important in understanding temporal trends in IAS between importation and establishment.[216] Non-traditional sources of data should be identified and employed, when possible. For example, citizen science programs, where volunteers assist scientists, can complement the labor-intensive data collection efforts required for IAS management, help to alleviate the drain on funding and resource expenditure,[217] and increase data set size, thus improving the ability to identify scientific anomalies, conduct comparative studies across space and time, and understand trends and variations among subpopulations or geographic regions.[218]

C. Stakeholder Engagement

While prioritization of resources and evidence-based decision-making are essential components of comprehensive reform, they are insufficient without "broader democratization of the policy-making process."[219] Positive stakeholder engagement (i.e., public awareness, understanding, and support) is therefore crucial to IAS management. While most IAS professionals (e.g., scientists, land managers, farmers) have a relatively firm understanding of the problems caused by IAS, considerable confusion about the subject exists across large segments of the general public.[220] Poor communication of strategic goals and underlying scientific rational can leave lay persons with fundamental misunderstandings of IAS management decisions.[221] Even when lay people have a basic understanding of the IAS problem, they may be "unfamiliar with the meaning and significance" of abstract concepts like biodiversity loss.[222] Such lack of understanding can lead to withdrawal of critical public support.[223]

Successful IAS management depends not only on having the proper regulatory tools and biological control techniques but also upon public acceptance.[224] Failure to account for public opinion presents a real risk of losing support for IAS[225] and loss of support can have far-reaching consequences, such as lawsuits against management agencies.[226] If too little

216. Travis D. Marsico et al., *Underutilized Resources for Studying the Evolution of Invasive Species During Their Introduction, Establishment, and Lag Phases*, 3 EVOLUTIONARY APPLICATIONS 203, 203 (2010).

217. Travis Gallo & Damon Waitt, *Creating a Successful Citizen Science Model to Detect and Report Invasive Species*, 61 BIOSIENCE 459, 459 (2011).

218. *See* Anne H. Toomey & Margret C. Domroese, *Can Citizen Science Lead to Positive Conservation Attitudes and Behaviors?*, 20 HUMAN ECOLOGY REV. 50, 50 (2013).

219. Jeremy Russell-Smith et al., *Moving Beyond Evidence-Free Environmental Policy*, 13 FRONTIERS ECOLOGY & ENV'T 441, 441 (2015).

220. Lodge & Shrader-Frechette, *supra* note 212, at 32.

221. Warner & Kinslow, *supra* note 126, at 2.

222. Michael J. Novecek, *Engaging the Public in Biodiversity Issues*, 105 PROC. NAT. ACAD. SCI. 11571, 11572 (2008).

223. *Id*.

224. Agnieszka Olszańska et al., *To Kill or Not to Kill - Practitioners' Opinions on Invasive Alien Species Management as a Step Towards Enhancing Control of Biological Invasions*, 58 ENVTL. SCI. & POL'Y 107, 107 (2016).

225. Dale Graeme Nimmo & Kelly K. Miller, *Ecological and Human Dimensions of Management of Feral horses in Australia: A Review*, 34 WILDLIFE RES. 408, 413 (2007).

226. Rodolphe E. Gozlan et al., *Understanding the Threats Posed by Non-Native Species: Public vs. Conservation Managers* 8 PLOS ONE 1, 1 (2013).

input presents the prospect of losing public support, too much input carries the risk that underlying scientific research is disregarded in favor of misplaced sentiment.[227] To date, "[a] lack of cohesion between scientific researchers, the commercial sector and policy makers lies at the root of a widespread failure to develop and implement sustainable management practices for invasive species."[228]

Awareness of IAS issues, while a necessary component of stakeholder engagement, is not sufficient alone to ensure that conservation behaviors match corresponding attitudes. For example, even members of the public who are educated on the subject may object to certain aspects of IAS management, such as lethal removal, which they find distasteful.[229] Importers of exotic species have a strong profit motive to keep importing where not prohibited by law.[230] Cultural- and value-driven differences of opinion can result in local communities rejecting advice from agency scientists, who are often seen as "outsiders".[231] Moreover, public perceptions of IAS efforts can be colored by negative opinions of government because public agencies are involved in the majority of IAS management efforts.[232] Other examples of poor stakeholder engagement include:

> science illiteracy, the related lack of public familiarity with ecological and evolutionary processes that inform conservation issues, an uncertainty as to why biodiversity conservation is good for individuals and society, a lack or impoverishment of experiences that put people into nature, the disinterest or even antagonism of media and other potential partners in outreach, mistrust of government, information overkill, and competitive choices (even often subliminal ones), such as unsustainable consumerism.[233]

These examples illustrate that IAS management efforts can be "more political, economic, and cultural than biological" and demonstrate the need to prioritize education and awareness, stakeholder engagement, and public support.[234]

Current stakeholder engagement provisions are inchoate and scattered across the landscape of incremental agency authority. IAS reform presents an opportunity to incorporate comprehensive goals, such as participation and democratization, into a new Federal framework.[235] These types of changes can help agencies build IAS management capacity by *increasing the number of stakeholders who actively support and participate in the process. Ideally, any reform measures would incorporate important socio-economic*

227. *See generally* Andrew T. Knight et al., *Knowing but Not Doing: Selecting Priority Conservation Areas and the Research-Implementation Gap*, 22 CONSERVATION BIOLOGY 610 (2008).

228. K.E. Stokes et al., *The Importance of Stakeholder Engagement in Invasive Species Management: A Cross-Jurisdictional Perspective in Ireland*, 15 BIODIVERSITY & CONSERVATION 2829.

229. *See* Stanley A. Temple, *The Nasty Necessity: Eradicating Exotics*, 4 CONSERVATION BIOLOGY 113, 113 (1990).

230. *See* Dianna K. Padilla & Susan L. Williams, *Beyond Ballast Water: Aquarium and Ornamental Trades as Sources of Invasive Species in Aquatic Ecosystems*, 2 FRONTIERS ECOLOGY & ENV'T 131, 131 (2004).

231. Warner & Kinslow, *supra* note 126, at 6.

232. *Id*.

233. Novecek, *supra* note 222, at 11572.

234. Ryan L. Sharp et al., *Factors Influencing Public Preferences for Invasive Alien Species Management*, 144 BIOLOGICAL CONSERVATION 2097, 2098 (2011)(emphasis added).

235. *See* Karin Bäckstrand, *Civic Science for Sustainability: Reframing the Role of Experts, Policy-Makers and Citizens in Environmental Governance*, 3 GLOBAL ENVTL. POL. 24, 24 (2003) (discussing stakeholder engagement in environmental decision-making).

and cultural aspects of IAS management, which have historically been overlooked.[236] Moreover, stakeholder engagement initiatives often produce improvements in other areas. For example, citizen science programs represent a prime opportunity to engage the public while complementing the resource and labor-intensive data collection efforts required for IAS management.[237] Leveraging multiple sources of support for IAS management is paramount to the success of reform efforts and will inevitably achieve more robust outcomes.

D. Agency Coordination and Accountability

Agencies have disparate missions and maintain distinct cultures. Despite executive-level parlance about the value of inter-agency cooperation, it has not produced long-term, legally-binding solutions to the problems associated with IAS. Several multi-agency groups have been established (e.g. Aquatic Nuisance Species Task Force, Federal Interagency Committee for the Management of Noxious and Exotic Weeds, Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens), but have primarily engaged in research funding and producing white papers. The guidance generated by these groups is helpful, but entirely voluntary even for member agencies. Despite some improvements in the new NISMP released in July 2016, NISC has utterly failed to accomplish its legally-binging mandates, and voluntary measures like task forces are insufficient substitutes.

The incremental state of IAS law is concurrently driving two other concerning trends related to agency coordination and accountability. First, many IAS management decisions fall on unit-level managers.[238] Leaving day-to-day responsibility to experts with first-hand knowledge of the resources they manage makes sense, but only if smart policy and sound science are guiding decision-making processes. In reality, many agency managers are held responsible for attaining only certain generic IAS goals (e.g., total acreage treated), but maintain wide discretion on completing those goals; they are not necessarily required to manage for specific environmental endpoints as is the case under other comprehensive environmental laws (e.g. ESA, CWA).[239] As such, unit managers are often free to choose the path of least resistance, and IAS hotspots can go unchecked until problems become endemic. Second, there is little formal accountability for agencies which fail to prioritize IAS management or attain specific goals. Exceptions to this pattern certainly exist - EPA has been sued (and has lost) multiple times over failure to adequately regulate ballast water exchanges under the Clean Water Act.[240] NEPA analysis has increasingly been used as an avenue for appeal; however, legal review processes for most IAS scenarios are murky, at best.

Once again, there is a compelling argument for comprehensive reform - in this case; to mandate meaningful agency coordination, prevent agencies from cherry-picking legal

236. *See* Sharp et al., *supra* note 234, at 2098.

237. Gallo & Waitt, *supra* note 217, at 461-62; *see* Jonathan Silvertown, *A New Dawn for Citizen Science*, 24 TRENDS ECOLOGY & EVOLUTION 467, 469 (2009).

238. *See* CONT'L FOREST DIALOGUE A DECISION-MAKING GUIDE FOR INVASIVE SPECIES PROGRAM MANAGERS 1 (2011), https://perma.cc/RA5X-93WG.

239. *See supra* Part II Sections a & b.

240. *See* Robert A. Noce, Note, *If a Regulation Falls in the Courts, and Nobody's There to Hear it…The Limited Impact of Northwest Environmental Advocates v. EPA on Federal Ballast Water Policy*, 16 MO. ENVTL. L & POL'Y REV. 594, 594 (2009).

authorities, expressly codify agency authorities and responsibilities, create avenues to compel agency action, and add much-needed oversight to the IAS management process. One of the most important, yet underperforming, aspects of Federal IAS management is interagency coordination, including the ability to work with state, local, and private entities. Comprehensive reform could be tailored to expressly define the manner and scope of agency coordination, along with clarifying specific roles and responsibilities of each agency, as is the case in other major Federal environmental legislation (e.g. CWA, ESA, and NEPA). Considerable fiscal benefits would likely be realized in the process by reducing the costs associated with redundancy, while closing existing gaps in coverage. Agency accountability would be greatly enhanced by requiring concrete action (i.e. a positive duty to act) and creating a well-defined judicial review process, to determine whether agencies have met legal requirements.

V. CONCLUSIONS

This paper contributes to the literature by providing a synthesis of existing Federal invasive alien species law and introducing some timely arguments for comprehensive reform. The current incremental structure of Federal IAS policy does not theoretically prohibit any of the recommendations herein. For example, APHIS has begun making headway for an expedited risk analysis program using its authority under PPA.[241] FWS is also achieving positive results with Ecological Risk Screening Summaries.[242] However, given the enormity of the task and the lack of success to date with incremental reforms, it is reasonable to conclude that comprehensive reform holds greater promise to reprioritize and reorganize Federal legal and policy responses to IAS. Specifically, comprehensive reform would help policy-makers develop rapid, accurate, and cost-effective management solutions. At the same time, funding processes would be consolidated, allowing decision-makers to focus and commit resources under a singular, cohesive, well-articulated IAS policy. Comprehensive reform is also the natural provenance for the creation of new evidence-based management tools that are critically needed, such as modeling and risk assessment methodologies, a publicly-accessible national IAS cyberinfrastructure, and citizen science programs. It would also better account for socioeconomic processes in IAS management, such as, planning for stakeholder engagement, public education and outreach, and democratization of IAS policy. Finally, comprehensive reform would encourage meaningful interagency coordination and add legally-binding measures of accountability. Given the shortcomings of current IAS law and policy identified in this report, the feasibility of comprehensive reform is ripe for more intensive investigation.

241. *See* 7 C.F.R. § 319.37-2a (2019). (The program establishes a new category of plants "whose importation is not authorized pending the completion of a pest risk analysis").

242. *See generally Ecological Risk Screening Summaries (ERSS)*, U.S. FISH & WILDLIFE SERV., https://perma.cc/SS9K-HMYS.

APPENDIX

Appendix A: Minor and Supplementary Sources of Federal Legal Authority

Alien Species Prevention and Enforcement Act

The Alien Species Prevention and Enforcement Act (ASPEA) makes it unlawful to ship, through U.S. Mail, certain species listed as injurious under the Lacey Act, as well as species prohibited by the Plant Quarantine Act.[243]

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA)[244] serves "to preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations[.]"[245] IAS issues could potentially be incorporated into state Coastal Zone Management Plans or through the National Estuarine Research Reserve System, both of which are established by CZMA.[246]

Executive Orders

Executive Order 13186 offers potential legal authority for IAS affecting migratory birds.[247] Executive Order 13653 may present legal authority for IAS challenges associated with climate change.[248] Executive Order 11990 provides for the protection of wetlands, including maintenance of natural systems.[249]

National Park System and National Wildlife Refuge System Legislation

The "fundamental purpose" of the National Park Service (NPS) is "to conserve the scenery, natural and historic objects, and wild life in the System…and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations,"[250] a mission which includes IAS management.[251] The National Wildlife Refuge System, managed by FWS, has similarly broad authority to administer lands and waters for conservation, management, and restoration.[252]

Public Health and Safety Laws

The Virus-Serum-Toxin Act (VSTA)[253] regulates the production, sale, barter, shipment and delivery of any "contaminated, dangerous, or harmful virus, serum, toxin, or

243. 39 U.S.C. § 3015(a), (c) (2018).

244. 16 U.S.C. § 1451-1466 (2018).

245. 16 U.S.C. § 1452(1) (2018).

246. *Summary of Federal Laws Relevant to Invasive Species*, GA. INVASIVE SPECIES TASK FORCE, https://perma.cc/64DP-YVVP.

247. Exec. Order No. 13186, 66 Fed. Reg. 3583 (Jan. 17, 2001).

248. Exec. Order No. 13653, 78 Fed. Reg. 66819 (Nov. 6, 2013).

249. Exec. Order No. 11990, 42 Fed. Reg. 26961 (May 24, 1977).

250. 54 U.S.C. § 100101 (2018).

251. *See generally Invasive & Non-Native Species*, NAT'L PARK SERV., https://perma.cc/M93T-KN8Z (archived Feb. 9, 2019).

252. 16 U.S.C. § 668dd(a)(2) (2018).

253. *See generally* 21 U.S.C. §§ 151-58 (2018).

analogous product intended for use in the treatment of domestic animals,"[254] and thus grants the federal government authority to regulate potential IAS in veterinary biologics. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 covers IAS pests and pathogens affecting livestock and human health.[255]

The Rivers and Harbors Act

The Rivers and Harbors Act (RHA) and its amendments, together the oldest set of Federal environmental laws, authorized USACE to control aquatic IAS through a number of programs, including the Aquatic Plant Control Program.[256] Research and technical support are delivered via the Aquatic Nuisance Species Research Program (ANSRP), Aquatic Plant Control Research Program (APCRP), the Invasive Species Center, Aquatic Plant Control Operations Support Center (APCOSC) , and Water Operations Technical Support (WOTS) Program.[257]

Various Fisheries Acts

The Magnuson-Stevens Fishery Conservation and Management Act (MSA)[258] The Magnuson-Stevens Fishery Conservation and Management Act (MSA)is the primary law governing fishing in Federal Waters. MSA and several related Acts provide NOAA fisheries broad authority to manage Federal fisheries and marine habitat.[259] The National Marine Sanctuary Act (NMSA) authorizes the Committee of Commerce to designate and protect certain areas as Marine Sanctuaries.[260] NOAA's Office of National Marine Sanctuaries has broad IAS management authority within designated areas.[261] The **Fish & Wildlife Coordination Act** (FWCA) authorizes NOAA Fisheries to review projects proposed or authorized by Federal agencies which impact fisheries and waterways.[262]

Various Forestry Acts

The **Organic Administration Act**[263] sets forth broad authority for USDA to manage and protect National Forest lands. The **Multiple Use Sustained Yield Act** (MUSY)[264] requires USFS to manage Federal forest lands for multiple uses, including timber, water quality, recreation, and habitat - all of which may be negatively affected by IAS. The Forest

254. 21 U.S.C. § 151 (2018).

255. *See* Public Health Security and Bioterrorism Preparedness and Response Act of 2002, Pub. L. No. 107-188, 116 Stat. 594 (2002).

256. 33 C.F.R. § 273.13 (2018); *see generally* Act of Sept. 1890, ch. 906-07, 26 Stat. 426 (1890).

257. *See generally Programs*, NAT. RES. MGMT. GATEWAY, https://perma.cc/K3XK-9MR3 (archived Oct. 24, 2018).

258. 16 U.S.C. §1801 (2018).

259. *Overview of Federal Statutes*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://perma.cc/MD8HQAAZ (archived Oct. 24, 2018) (NOAA Fisheries Agency regulations related to the Magnuson-Stevens Fishery Conservation and Management Act are codified at 50 C.F.R. Part 600).

260. 16 U.S.C. §1431(c) (2018).

261. 16 U.S.C. §1431(b).

262. 16 U.S.C. § 661 (2018).

263. *See* 16 U.S.C. § 551 (2018).

264. *See* 16 U.S.C. §§ 528-31 (2018).

and **Rangeland Renewable Resources Planning Act** (FRRRPA),[265] as amended by the National Forest Management Act,[266] is a primary statue covering planning, research, and funding activities for the National Forest System. The **Health Forests Restoration Act** (HFRA)[267] expressly applies to biodiversity[268] and insect infestations.[269] The **Public Lands Corps Act,** as amended by the **Public Lands Corps Healthy Forests Restoration Act**,[270] grants priority to projects which "address the impact of insect or disease infestations or other damaging agents on forest and rangeland health"[271] or "improve biological diversity."[272] USFS practices are also guided by the National Strategic Framework for Invasive Species Management.[273]

Vector-Specific Acts

Congress has passed a number of statutes aimed at controlling or eradicating specific IAS vectors, including the **Nutria Eradication and Control Act**[274], the **Brown Tree Snake Control and Eradication Act**[275], the **National Plan for Control and Management of Sudden Oak Death**[276], the **Asian Carp Prevention and Control** Act[277], **Great Lakes Fish and Wildlife Restoration Act**,[278] and **the Salt Cedar and Russian Olive Control Demonstration Act**.[279]

265. *See* 16 U.S.C. §§1671-76 (2018).
266. *See* 16 U.S.C. §1604 (2018).
267. *See* 16 U.S.C. §§ 6501-02 (2018).
268. *See* 16 U.S.C. § 6501 (2018).
269. *See* 16 U.S.C. §§ 6551-56 (2018).
270. 16 U.S.C. §§ 1722-30 (2018).
271. 16 U.S.C. § 1722 (8)(C) (2018).
272. 16 U.S.C. § 1722 (8)(D)(ii).
273. U.S. FOREST SERV., FOREST SERVICE NATIONAL STRATEGIC FRAMEWORK FOR INVASIVE SPECIES MANAGEMENT 4 (2013), https://perma.cc/V87A-XQMU.
274. Nutria Eradication and Control Act of 2003, Pub. L. No. 108-16, 117 Stat. 621 (2003).
275. 7 U.S.C. §§ 8501-07 (2018).
276. 7 U.S.C. § 7720 (2018).
277. Asian Carp Prevention and Control Act, Pub. L. No. 111-307, 124 Stat. 3282 (2010).
278. Great Lakes Fish and Wildlife Restoration Act of 1990, Pub. L. No. 101-537, 104 Stat. 2370 (1990).
279. Salt Cedar and Russian Olive Control Demonstration Act, Pub. L. No. 109-320, 120 Stat. 1748 (2006).

Appendix B: Federal IAS Legal Authority for Selected Agencies

Agency	**Major Responsibilities and Activities**	**Selected Authorities (as amended)**
Department of Agriculture		
Animal and Plant Health Inspection Service (APHIS)	Protects U.S. agriculture from domestic and foreign pests and diseases, responds to domestic animal and plant health problems, and facilitates agricultural trade. As part of its regulatory framework, APHIS has oversight of animal and plant health, including the prevention of foreign diseases and pests, eradication, and containment of such problems domestically.	Animal Health Protection Act (7 U.S.C. §§8301-8322); Plant Health Protection Act (7 U.S.C. §§7701-7721); Agricultural Bioterrorism Act (7 U.S.C. §8401); Animal Damage Control Act (7 U.S.C. §§426 et seq.); Federal Seed Act (7 U.S.C. §§1551 et seq.); Federal Noxious Weed Act (7 U.S.C. §2814); Noxious Weed Control and Eradication Act of 2004 (7 U.S.C. §§7781-7786); National Environmental Policy Act (42 U.S.C. §§4321 et seq.); among other authorities.
Agricultural Research Service (ARS), Economic Research Service (ERS), and National Institute of Food and Agriculture (NIFA).	ARS is USDA's chief scientific in-house research agency. Provides scientific and technical support for its regulatory agencies. ERS is USDA's economic research agency and supports invasive species efforts through its various research programs. NIFA coordinates and administers Federal funding of land grant and other institutions to conduct agricultural	Numerous laws dating to the Department of Agriculture Organic Act of 1862 (7 U.S.C. §2201 note), up through and including various omnibus farm bill laws.

	and food research, and education activities, including research on invasive species.	
Farm Service Agency (FSA)	In managing the Conservation Reserve Program (CRP), requires all participants to control weeds (including noxious weeds), insects, pests, and other undesirable species on enrolled lands	Provisions governing CRP (16 U.S.C. §§3838a, 3832); National Environmental Policy Act (42 U.S.C. §§4321 et seq.).
Foreign Agricultural Service (FAS)	Works with APHIS, helps provide invasive species technical assistance to foreign countries.	See laws and statutes under APHIS.

U.S. Forest Service (USFS)	Manages invasive activities on 193 million acres of national forests and grasslands, as well as supports activities outside the United States.	Organic Administration Act of 1897 (16 U.S.C. §551); Multiple-Use Sustained-Yield Act (16 U.S.C. §§528-531); Forest and Rangeland Renewable Resources Planning Act (16 U.S.C. §§1671 et seq.), as amended by the National Forest Management Act (16 U.S.C. §1604); Federal Noxious Weed Act (7 U.S.C. §2814); Public Rangelands Improvement Act (43 U.S.C. §§1901 et seq.); Federal Land Policy and Management Act (43 U.S.C. §1701 et seq.); Hawaii Tropical Forest Recovery Act (16 U.S.C. §4503(note)); Cooperative Forestry Assistance Act (16 U.S.C. §§2101-2111); sections of the International Forestry Cooperation Act (16 U.S.C. §4501(b)); National Environmental Policy Act (42 U.S.C. §§4321 et seq.); among other laws.
Natural Resources Conservation Service (NRCS)	Provides technical assistance to cooperating landowners and Federal agencies (such as the Forest Service and Bureau of Land Management) to adopt conservation practices on agricultural land, including rangeland, and promotes conservation planning through many of its farmland conservation programs.	Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. §4701, et seq.); Endangered Species Act (16 U.S.C. §§1531-1543); Fishery Conservation and Management Act (16 U.S.C. §§1801-1882); Coastal Zone Management Act (16 U.S.C. §§1451 et seq.); Interjurisdictional Fisheries Act (16 U.S.C. §§4101 et seq.); National Environmental Policy Act (42 U.S.C. §§4321 et seq.).
Department of Commerce		

National Oceanic and Atmospheric Administration (NOAA)	Administers a variety of programs aimed at expanding and coordinating prevention, early detection, rapid response, control, and monitoring responsibilities. NOAA is also the statutory co-chair of both the interagency Aquatic Nuisance Species (ANS) Task Force and National Invasive Species Council (NISC).	Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. §4701, et seq.); Endangered Species Act (16 U.S.C. §§1531-1543); Fishery Conservation and Management Act (16 U.S.C. §§1801-1882); Coastal Zone Management Act (16 U.S.C. §§1451 et seq.); Interjurisdictional Fisheries Act (16 U.S.C. §§4101 et seq.); National Environmental Policy Act (42 U.S.C. §§4321 et seq.).
Department of Defense		
US Army Corps of Engineers (USACE)	Maintains programs that address subcategories of invasive species and provides guidance and research assistance on invasive species control strategies. Provides support to states for aquatic plant management and funds control of invasive aquatic plants in certain southeastern states.	Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. §§4701, et seq.), Rivers and Harbors Appropriation Act (33 U.S.C. §403); Water Resources Development Act (§3061); and National Environmental Policy Act (42 U.S.C. §§4321 et seq.).
Department of Health and Human Services		
Centers for Disease Control (CDC) and National Institutes of Health (NIH)	CDC addresses zoonotic and emerging diseases. NIH supports zoonotic and bioterrorism	Homeland Security Act of 2002 (6 U.S.C. §§101 et seq.); sections of the Public Health Service Act (42 U.S.C. §201 et seq.) and other public health authorities.

	preparedness research.	
Department of Homeland Security		
US Coast Guard (USCG)	Responsible for developing and implementing a ballast water management program to prevent the unintentional introduction/dispersal of nonindigenous aquatic species from ship ballast water	Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. §§4701, et seq.); Federal Water Pollution Control Act of 1948 (also known as Clean Water Act, 33 U.S.C. §§1251-1376); National Environmental Policy Act (42 U.S.C. §§4321 et seq.).
Customs and Boarder Protection (CBP)	Responsible for border protection and facilitating lawful international trade and travel. Works with other Federal agencies to enforce laws prohibiting or limiting the entry of invasive species	Homeland Security Act of 2002 (6 U.S.C. §§101 et seq.); Tariff Act (19 U.S.C. §§1202-1654).
Federal Emergency Management Agency (FEMA)	Works with other Federal, state, tribal, and local authorities to control and eradicate outbreaks of animal/zoonotic disease, exotic plant pests, or invasive plant pest infestations; also contributes to the protection of natural and cultural resources.	Homeland Security Act of 2002 (6 U.S.C. §§101 et seq.); National Environmental Policy Act (42 U.S.C. §§4321 et seq.); among other authorities.
Immigration & Customs Enforcement	DHS' principal investigative arm, responsible for border	Homeland Security Act of 2002 (6 U.S.C. §§101 et seq.).

(ICE)	control, customs, trade and immigration.	
Department of the Interior		
Bureau of Indian Affairs (BIA)	Helps support the management of non-native species on Indian lands through its exotic weed eradication and other programs.	Federal Noxious Weed Act (7 U.S.C. §2814); National Environmental Policy Act (42 U.S.C. §§4321 et seq.); among other authorities.
Bureau of Land Management (BLM)	Controls for non-native and invasive plants on land it manages, primarily in western states and Alaska.	Federal Land Policy and Management Act of 1976 (43 U.S.C. §§1701 et seq.); National Environmental Policy Act (42 U.S.C. §§4321 et seq.); among other authorities.
Bureau of Reclamation	Conducts research, prevention, detection, and controls to address pests of aquatic systems such as reservoirs, canals, pipelines, and rivers.	Reclamation Act of 1902 (43 U.S.C. §391h); Fish and Wildlife Coordination Act (16 U.S.C. §§661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401); National Environmental Policy Act (42 U.S.C. §§4321 et seq.).
Fish and Wildlife Service (FWS)	Works to conserve, protect, and enhance fish, wildlife, plants and their habitats. Works to prevent the introduction and spread of invasive species, and on controlling established non-native species, often working with other agencies (USDA, NOAA, and CBP). Maintains programs covering fisheries, endangered species,	Lacey Act (18 U.S.C. §§42-43; 16 U.S.C. §§3371-3378); Endangered Species Act (16 U.S.C. §1531-1543); Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. §§4701, et seq.); Wild Bird Conservation Act (16 U.S.C. §§4901, et seq.); Hawaii Tropical Forest Recovery Act (16 U.S.C. §4503(note)); National Environmental Policy Act (42 U.S.C. §§4321 et seq.); among other authorities.

	habitat conservation, refuge operations and maintenance, and international affairs.	
Geological Survey (USGS)	Supports efforts to identify, document, disseminate, and integrate information about the nation's biological resource, including nonindigenous species.	Organic Act of March 3, 1879 (43 U.S.C. 31); Fish and Wildlife Resources Cooperative Agreements (16 U.S.C. §753 a); Agreements to Implement the Convention on Great Lakes Fisheries between the United States and Canada (16 U.S.C. §§931-939); Clean Water Act (33 U.S.C. §§1251-1387); among other authorities.
National Park Service (NPS)	Uses an integrated pest management approach to manage exotic species and targets specific sites or species. Regulates fishing on its lands and prohibits the possession or use of certain bait for fishing.	National Park System (16 U.S.C. §§1 et seq.; 16 U.S.C. §594); Endangered Species Act (16 U.S.C. §1531 et seq.); Noxious Weed Control and Eradication Act (7 U.S.C. §§7781-7786); Plant Protection Act (7 U.S.C. §7701 et seq.); National Invasive Species Act (16 U.S.C. 4701); Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. §§4701); Animal Damage Control Act (7 U.S.C. §§426-426c); and National Environmental Policy Act (42 U.S.C. §§4321 et seq.); among other authorities.

Office of Surface Mining Reclamation and Enforcement (OSM)	Addresses the use of introduced species in mine reclamation areas for revegetation of impacted lands through regulations governing coal mining operations.	Regulations implementing the Surface Mining Control and Reclamation Act (30 U.S.C. §§1201 et seq.).
Department of State		
Various Bureaus and Offices	Works with other Federal agencies, states, tribes, non-governmental organizations and industry to develop U.S. foreign policy on invasive species.	State Department Basic Authorities Act (22 U.S.C. §2651a); among other domestic and international legal authorities.
Department of Transportation		
Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), and the Federal Railroad Administration (FRA)	Cooperates with other Federal and state agencies to develop a strategy to reduce the risk of introducing invasive species at airports, highways, and rail corridors.	Various environmental laws such as Endangered Species Act of 1973 (16 U.S.C. §1531 et seq.); Clean Water Act (33 U.S.C. §§1251-1387); Animal Damage Control Act (7 U.S.C. §§426 et seq.); National Environmental Policy Act (42 U.S.C. §§4321 et seq.).
Independent Agencies		
U.S. Agency for International Development	Responsible for ensuring that U.S. development of assistance programs do not lead to the introduction of invasive species in other nations and supports eradication and control of invasive species in developing countries.	Foreign Assistance Act of 1961 (22 U.S.C. §§2347 et seq.), among other legal authorities.

U.S. Environmental Protection Agency (EPA)	Assists with cooperative efforts regarding early detection and rapid response to potential invasive species. Conducts and supports research on the prevention, early detection, control, and management of invasive species. Responsible for establishing numeric limits on organisms in ballast water discharges, as well as additional monitoring and reporting of vessel discharges	Clean Water Act (33 U.S.C. §§1251-1387); National Environmental Policy Act (42 U.S.C. §§4321 et seq.), among other environmental laws and authorities.

Source: M. Lynn Corn & Renèe Johnson, Congressional Research Service, *Invasive Species: Major Laws and the Role of Selected Federal Agencies* 49-54 (2013).

Appendix C: Additional IAS Management Resources

Animal and Plant Health Inspection Service -Hungry Pests

http://hungrypests.com/the-spread/

Animal and Plant Health Inspection Service - Noxious Weeds Program

https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/SA_Weeds/SA_Noxious_Weeds_Program

Aquatic Nuisance Species Task Force

http://www.anstaskforce.gov/default.php

Bureau of Land Management Weed Management and Invasive Species Program

http://www.blm.gov/wo/st/en/prog/more/weeds/blm_program.html

Center for Invasive Species and Ecosystem Health

http://www.invasive.org/index.cfm

Department of Defense - Commanders Guide on Invasive Species

http://www.dodinvasives.org/files/Invasive_Species_Commanders_Guide.pdf

Department of the Interior - Invasive Species Management Statement

https://www.doi.gov/ocl/hearings/113/invasivespeciesmanagement_051613

National Invasive Species Council

Federal Interagency Committee for the Management of Noxious and Exotic Weeds

http://www.fs.fed.us/ficmnew/

Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens

https://www.itap.gov/

Global Invasive Species Database

http://www.iucngisd.org/gisd/

Global Invasive Species Programme

http://www.diversitas-international.org/activities/past-projects/global-invasive-species-programme-gisp

National Agricultural Law Center - Invasive Species: Major Laws

http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R43258.pdf

National Invasive Species Council

https://www.doi.gov/invasivespecies

National Invasive Species Information Center

https://www.invasivespeciesinfo.gov/index.shtml

National Oceanic and Atmospheric Administration - Invasive Species Program

http://www.habitat.noaa.gov/restoration/programs/invasivespecies.html

National Park Service - Invasive Species

http://www.nature.nps.gov/biology/invasivespecies/

National Plant Board - State IAS Laws and Regulations

http://nationalplantboard.org/laws-and-regulations/

Natural Resource Conservation Service - Noxious Weeds

https://plants.usda.gov/java/noxiousDriver#state

U.S. Army Corps of Engineers - Invasive Species Management

http://www.usace.army.mil/Missions/Environmental/Invasive-Species-Management/

U.S. Fish and Wildlife - Invasive Species

https://www.fws.gov/invasives/

U.S. Forest Service - Invasive Species Program

http://www.fs.fed.us/invasivespecies/

U.S. Geological Survey - Invasive Species

https://www2.usgs.gov/ecosystems/invasive_species/

U.S. Geological Survey - Nonindigenous Aquatic Species

http://nas.er.usgs.gov/queries/StateSearch.aspx

Appendix D: Executive Order 13112

Executive Order 13112 - Invasive Species

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.) Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

Section 1. Definitions.

(a) "Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) "Ecosystem" means the complex of a community of organisms and its environment.

(d) "Federal agency" means an executive department or agency but does not include independent establishments as defined by 5 U.S.C. 104.

(e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, state, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Sec. 2. Federal Agency Duties.

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Sec. 3. Invasive Species Council.

(a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with

concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, state, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Sec. 4. Duties of the Invasive Species Council.

The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, state, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

Sec. 5. Invasive Species Management Plan.

(a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

Sec. 6. Judicial Review and Administration.

(a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust

responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C 4713 with respect to ballast water programs.

(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

Source: Federal Register, Presidential Documents, *Executive Order 13112 - Invasive Species*, https://www.federalregister.gov/articles/1999/02/08/99-3184/invasive-species

Appendix E: Federal Noxious Weed List

Latin Name	**Common Name(s)**	**Type**
Azolla pinnata	Mosquito fern, water velvet	Aquatic
Caulerpa taxifolia	Killer algae	Aquatic
Eichhornia azurea	Anchored/rooted waterhyacinth	Aquatic
Hydrilla verticillata	Hydrilla	Aquatic
Hygrophila polysperma	Miramar weed	Aquatic
Ipomoea aquatica	Water-spinach,swamp morning glory	Aquatic
Lagarosiphon major	African elodea	Aquatic
Limnophila sessiliflora	Ambulia	Aquatic
Melaleuca quinquenervia	Broadleaf paper bark tree	Aquatic
Monochoria hastata	Arrowleaf false pickerelweed	Aquatic
Monochoria vaginalis	Heartshape false pickerelweed	Aquatic
Ottelia alismoides	Duck lettuce	Aquatic
Sagittaria sagittifolia	Arrowhead	Aquatic
Salvinia auriculata	Giant salvinia	Aquatic
Salvinia biloba	Giant salvinia	Aquatic
Salvinia herzogii	Giant salvinia	Aquatic
Salvinia molesta	Giant salvinia	Aquatic
Solanum tampicense	Wetland nightshade	Aquatic
Sparganium erectum	Exotic bur-reed	Aquatic
Aeginetia spp.	Varies by species	Parasitic

Latin Name	**Common Name(s)**	**Type**
Alectra spp.	Varies by species	Parasitic
Cuscuta spp.(except natives)	Dodders	Parasitic
Orobanche spp. (except natives)	Broomrapes	Parasitic
Striga spp.	Witchweeds	Parasitic
Acacia nilotica	Prickly acacia	Terrestrial
Ageratina adenophora	Crofton weed	Terrestrial
Ageratina riparia	Mistflower, spreading snakeroot	Terrestrial
Alternanthera sessilis	Sessile joyweed	Terrestrial
Arctotheca calendula	Capeweed	Terrestrial
Asphodelus fistulosis	Onionweed	Terrestrial
Avena sterilis	Animated oat, wild oat	Terrestrial
Carthamus oxyacantha	Wild safflower	Terrestrial
Chrysopogon aciculatus	Pilipiliula	Terrestrial
Commelina benghalensis	Benghal dayflower	Terrestrial
Crupina vulgaris	Common crupina	Terrestrial
Digitaria scalarum	African couchgrass, fingergrass	Terrestrial
Digitaria velutina	Velvet fingergrass, annual couchgrass	Terrestrial
Drymaria arenariodes	Lightning weed	Terrestrial
Emex australis	Three-corned jack	Terrestrial
Emex spinosa	Devil's thorn	Terrestrial

Latin Name	**Common Name(s)**	**Type**
Euphorbia terracina	False caper, Geraldton carnation weed	Terrestrial
Galega officinalis	Goatsrue	Terrestrial
Heracleum mantegazzianum	Giant hogweed	Terrestrial
Imperata brasiliensis	Brazilian satintail	Terrestrial
Imperata cylindrica	Cogongrass	Terrestrial
Inula britannica	British yellowhead	Terrestrial
Ischaemum rugosum	Murainograss	Terrestrial
Leptochloa chinensis	Asian sprangletop	Terrestrial
Lycium ferocissimum	African boxthorn	Terrestrial
Lygodium flexuosum	Maidenhair creeper	Terrestrial
Lygodium microphyllum	Old world climbing fern	Terrestrial
Melastoma malabathricum	Malabar melastome	Terrestrial
Mikania cordata	Mile-a-minute	Terrestrial
Mikania micrantha	Bittervine	Terrestrial
Mimosa invisa	Giant sensitive plant	Terrestrial
Mimosa pigra	Catclaw mimosa	Terrestrial
Moraea collina	Cape tulip	Terrestrial
Moraea flaccida	One leaf cape tulip	Terrestrial
Moraea miniata	Two leaf cape tulip	Terrestrial
Moraea ochroleuca	Apricot tulip	Terrestrial
Moraea pallida	Yellow tulip	Terrestrial

Latin Name	**Common Name(s)**	**Type**
Nassella trichotoma	Serrated tussock	Terrestrial
Onopordum acaulon	Stemless thistle	Terrestrial
Onopordum illyricum	Illyricum thistle	Terrestrial
Opuntia aurantiaca	Jointed prickly pear	Terrestrial
Oryza longistaminata	Red rice	Terrestrial
Oryza punctata	Red rice	Terrestrial
Oryza rufipogon	Red rice	Terrestrial
Paspalum scrobiculatum	Kodo-millet	Terrestrial
Pennisetum clandestinum	Kikuyugrass	Terrestrial
Pennisetum macrourum	African feathergrass	Terrestrial
Pennisetum pedicellatum	Kyasumagrass	Terrestrial
Pennisetum polystachion	Missiongrass, thin napiergrass	Terrestrial
Prosopis alpataco	Mesquite	Terrestrial
Prosopis argentina	Mesquite	Terrestrial
Prosopis articulata	Velvet mesquite	Terrestrial
Prosopis burkartii	Mesquite	Terrestrial
Prosopis caldenia	Calden	Terrestrial
Prosopis calingastana	Cusqui	Terrestrial
Prosopis campestris	Mesquite	Terrestrial
Prosopis castellanosii	Mesquite	Terrestrial
Prosopis denudans	Mesquite	Terrestrial
Prosopis elata	Mesquite	Terrestrial

Latin Name	**Common Name(s)**	**Type**
Prosopis farcta	Syrian mesquite	Terrestrial
Prosopis ferox	Mesquite	Terrestrial
Prosopis fiebrigii	Mesquite	Terrestrial
Prosopis hassleri	Mesquite	Terrestrial
Prosopis humilis	Algaroba	Terrestrial
Prosopis kuntzei	Mesquite	Terrestrial
Prosopis pallida	Kiawe, algarroba	Terrestrial
Prosopis palmeri	Mesquite	Terrestrial
Prosopis reptans	Tornillo	Terrestrial
Prosopis rojasiana	Mesquite	Terrestrial
Prosopis ruizlealii	Mesquite	Terrestrial
Prosopis ruscifolia	Mesquite	Terrestrial
Prosopis sericantha	Mesquite	Terrestrial
Prosopis strombulifera	Argentine screwbean	Terrestrial
Prosopis torquata	Mesquite	Terrestrial
Rottboellia cochinchinensis	Itchgrass	Terrestrial
Rubus fruticosis	Wild blackberry	Terrestrial
Rubus moluccanus	Wild raspberry	Terrestrial
Saccharum spontaneum	Wild sugarcane	Terrestrial
Sagittaria sagittifolia	Arrowhead	Terrestrial
Salsola vermiculata	Wormleaf salsola	Terrestrial
Senecio inaequidens	South African ragwort	Terrestrial

Latin Name	**Common Name(s)**	**Type**
Senecio	Fireweed	Terrestrial
Setaria pumila ssp. pallidefusca	Cattail grass (Updated 9/30/2014)	Terrestrial
Solanum torvum	Turkeyberry	Terrestrial
Solanum viarum	Tropical soda apple	Terrestrial
Spermacoce alata	Winged false buttonweed	Terrestrial
Tridax procumbens	Coat buttons	Terrestrial
Urochloa panicoides	Liverseed grass	Terrestrial

Source: US Department of Agriculture, Animal and Plant Health Inspection Service, *Federal Noxious Weed List*, https://www.aphis.usda.gov/plant_health /plant_pest_info/weeds/downloads /weedlist.pdf

Appendix F: Glossary of Acronyms

ADCA: Animal Damage Control Act
AMS: Agricultural Marketing Service
APHIS: Animal and Plant Health Inspection Service
CBA: Clean Boating Act
CEQ: Council on Environmental Quality
CFAA: Cooperative Forestry Assistance Act
CFR: Code of Federal Regulations
CWA: Clean Water Act
CZMA: Coastal Zone Management Act
DOC: Department of Commerce
DOI: Department of the Interior
EA: Environmental Assessment
EIS: Environmental Impact Statement
EO13112: Executive Order 13112
EPA: Environmental Protection Agency
ESA: Endangered Species Act
FWS: Fish and Wildlife Service
FIFRA: The Federal Insecticide, Fungicide, and Rodenticide Act
FNWA: Federal Noxious Weed Act
FSA: Federal Seed Act
FWCA: Fish & Wildlife Coordination Act
FWS: U.S. Fish and Wildlife Service
HTFRA: Hawaii Tropical Forest Recovery Act
IAS: Invasive Alien Species
IFCA: International Forest Cooperation Act
IPM: Integrated Pest Management
NANCA: Nonindigenous Aquatic Nuisance and Control Act
NEPA: National Environmental Policy Act
NISA: National Invasive Species Act
NISC: National Invasive Species Council
NISMP: National Invasive Species Management Plan
NOAA Fisheries: Formerly the National Marine Fisheries Service
NOAA: National Oceanic and Atmospheric Administration
NRCS: Natural Resource Conservation Service
NPDES: National Pollutant Discharge Elimination System
NWCEA: Noxious Weed Control and Eradication Act
PPA: Plant Protection Act
RA: Risk Assessment
RHA: Rivers and Harbors Act

SCDAA: Soil Conservation and Domestic Allotment Act
USACE: U.S. Army Corps of Engineers
USC: United States Code
USCG: United States Coast Guard
USDA: United States Department of Agriculture
USFS: U.S. Forest Service
VGP: Vessel General Permit
VSTA: Virus-Serum-Toxin Act