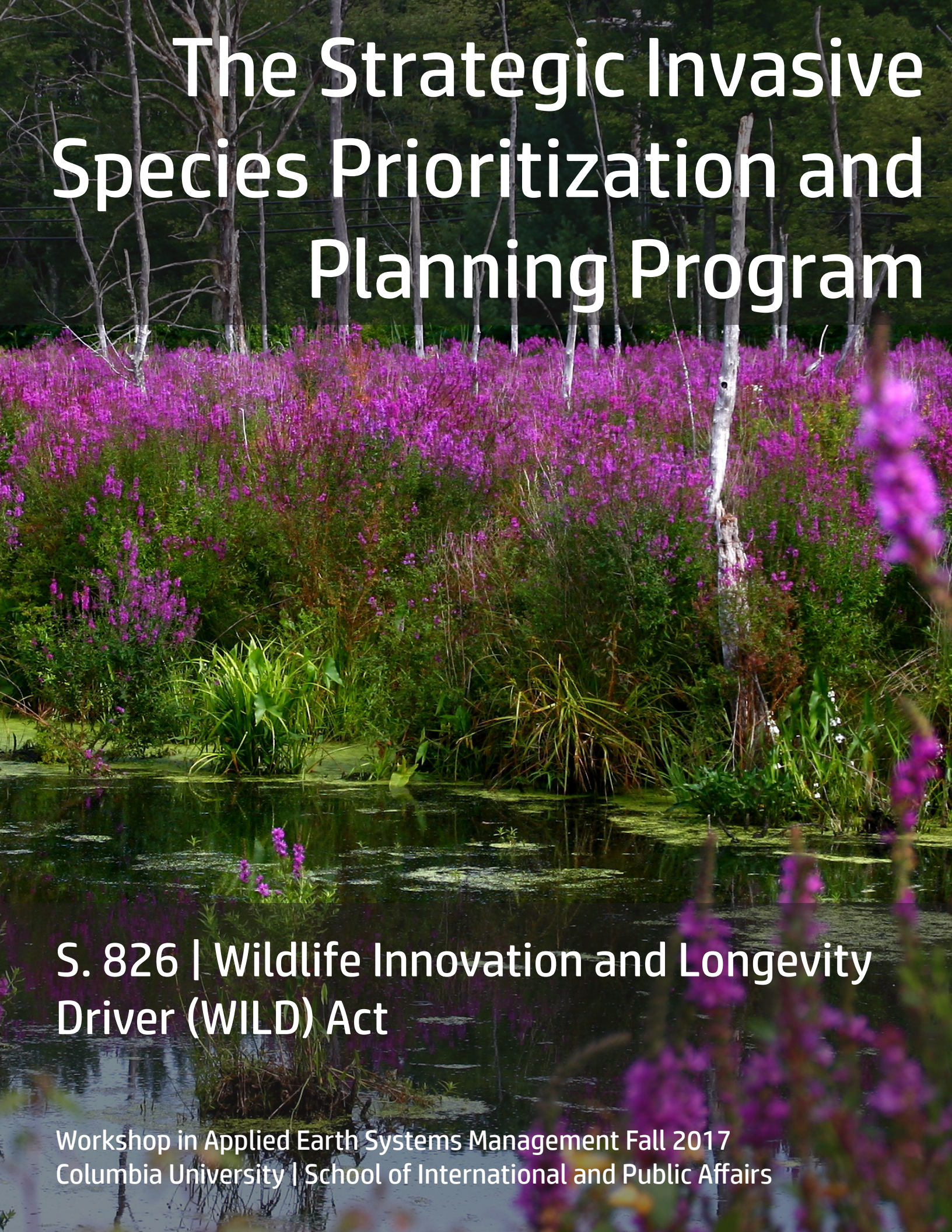

The Strategic Invasive Species Prioritization and Planning Program

S. 826 | Wildlife Innovation and Longevity Driver (WILD) Act

Workshop in Applied Earth Systems Management Fall 2017
Columbia University | School of International and Public Affairs

The Strategic Invasive Species Prioritization and Planning Program:
S.826|Wildlife Innovation and Longevity Driver (WILD Act)

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Front Cover
Purple Loosestrife (*Lythrum salicaria)* is an aquatic invasive plant known to degrade wetlands in the United States. Image adapted from Wikimedia Commons.

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Executive Summary

Invasive species are one the greatest threats to biodiversity worldwide. When invasive species are introduced into new environments, they often have few predators and can quickly outcompete native organisms. This kind of disruption alters ecosystem dynamics and can lead to the decimation of native species (Szyniszewska, 2007). The U.S. grapples with a variety of invasive plants, animals, and insects that cause billions of dollars of damage each year (S. 826 - WILD Act, 2017). Kudzu, known as the "vine that ate the South," grows up to one foot per day and has blanketed millions of acres of U.S. lands (Nature Conservancy, 2017). The invasion of the zebra mussel in the Great Lakes adversely impacted the aquatic ecosystem and caused major infrastructure damage (Benson, 2016). In the U.S. alone, it is estimated that the spread of invasives has led to the decline of 42 percent of listed threatened and endangered species (Dalsimer, 2002). Effective federal management is crucial to combat the complex invasive species challenge. While the National Invasive Species Council (NISC) provides leadership to prevent, eradicate and control invasives, there are some gaps in current management efforts.

The Wildlife Innovation and Longevity Driver (WILD) Act is a four-provision bill that aims to preserve global diversity by addressing threats to wildlife and their habitats. Implementation models exist for each of the bill's provisions except the Amendment to the Fish and Wildlife Coordination Act (FWCA). The Amendment to the FWCA seeks to reduce the population of invasive species domestically by bolstering federal management and control efforts. It requires the nine federal agencies that manage public land and water domestically to create and implement strategic plans for invasive species management. While this legislation has not yet been enacted, this report presents a comprehensive program design and first year implementation model, titled the Strategic Invasive Species Prioritization and Planning Program (the Program), for the Amendment to the FWCA.

The Program includes the following elements: 1) a framework for the creation of strategic plans and a methodology for invasive species prioritization, 2) a reporting mechanism that provides feedback for agencies to help ensure project success, and 3) a strategy to improve communication and coordination among the federal agencies and departments involved. These combined efforts serve to achieve the Program's goal to enhance strategic planning and coordination for federal invasive species management. The Program proposes the addition of two new staff positions to the Department of Interior and requires an estimated $749K year one budget. It also delineates a timeline for required tasks and includes the routine measurement and evaluation of progress according to a performance management system. With strategic planning, better informed management efforts, and stronger collaboration, the Program aims to support the national strategy to mitigate the threats posed by invasive species to the nation's waters, lands, and wildlife.

1. Introduction

Invasive species are one of the most significant global threats to biodiversity. Invasive species, most of which are introduced by human activity, can alter ecosystem dynamics, outcompete native species for resources, and decimate native wildlife populations (Szyniszewska, 2007). Invasive species not only disrupt the environment, but also adversely impact the economy, infrastructure and human health. The invasive species problem is further exacerbated by anthropogenic activities such as changes in land use, which leave habitats more susceptible to invasive species. In addition, the long-term impacts of climate change are expected to reduce the resilience of ecosystems and amplify the impacts of invasive species (National Invasive Species Council, 2016). Combatting this threat is a complex, costly challenge for the federal government. In the U.S. alone, the damage caused by invasive species is an estimated $120 billion annually (Morisson et al., 2005). Effective invasive species management and control is critical to protect the nation's wildlife, fisheries, forests, and agricultural lands.

The Amendment to the Fish and Wildlife Coordination Act (FWCA) is a provision included in the WILD Act, which was introduced in the U.S. House of Representatives after passing the Senate in June 2017. The Amendment to the FWCA aims to enhance federal capacity to combat invasive species domestically. It requires the nine federal agencies that manage land and water resources to develop strategic plans and carry out invasive species management and control efforts. This report examines the invasive species problem, analyzes current federal management practices and details a proposed program for the implementation of this amendment.

The first year implementation of the Strategic Invasive Species Prioritization and Planning Program (The Program) focuses specifically on the development of a framework which will guide the process of creating strategic plans across the relevant agencies. It builds upon several current invasive species management needs that have been identified by the National Invasive Species Council (NISC), which provides high-level leadership on national invasive species efforts. The NISC Secretariat, housed under Department of the Interior (DOI), is primarily responsible for overseeing the Council's activities and plays an integral role in the implementation of the Program. The Program intends to enhance invasive species planning and coordination efforts and contribute to the Amendment to the FWCA's overarching goal to combat the national threat of invasive species.

2. Invasive Species: A Growing Challenge

2.1 Scope of the Problem

Invasive species pose one of the most serious threats to ecosystems and natural resources. Many invasive species can take over habitats, devastate entire populations of native wildlife and threaten the nation's fisheries, forests and agricultural lands. Invasive species are defined as non-native species that do or can cause harm to the economy, the environment, or human health (S. 826 - WILD Act, 2017). Non-native or exotic species that are introduced to an ecosystem are not necessarily considered invasive and can even be beneficial. Potatoes and wheat, for example, are non-native plants introduced to the U.S. and are staple agricultural products (Simberloff, 2013). Invasive non-native species, on the other hand, tend to have few natural predators and can outcompete native species and disrupt ecosystems. Cheatgrass, an invasive highly flammable weed found in the western United States, quickly proliferates and creates an abundant fuel source for large wildfires. This plant has been responsible for increasing the frequency of historic wildfires and threatening biodiversity and livestock across western rangelands (U.S. DOI, 2016). Asian carp, native to Southeast Asia, are voracious eaters that have taken over aquatic ecosystems and now comprise up to 75% of fish biomass in the Mississippi and Illinois Rivers (Ghosal et al., 2016).

Increased globalization and trade are responsible for the transport of many invasive species both intentionally and unintentionally. Cheatgrass was introduced to the U.S. via ship ballast water in the late 1800s from eastern Europe and Asia unintentionally (Montana State University, 2008). Animals and plant species are also transported around the world for sale as pets or for food. Asian carp, for example,

Case Study 1: Invasive Species Management Methods - A Closer Look

Invasive species management utilizes several methods including prevention, eradication, and control. Prevention methods, such as improved habitat monitoring, public education, and regulation of imports, serve as the first line of defense in combating the introduction of invasive species. Once an invasive species has been introduced, early detection and rapid response (EDRR) is critical in containing invasions before invasive species populations become widely established (U.S. DOI, 2016). Control methods include chemical controls, such as herbicides or pesticides, mechanical controls, such as cutting and constructing barriers, and biological controls that use other animals to curtail invasive populations (Gherardi et al., 2009).

Eradication is the removal of every potentially reproducing individual of an invasive species from an area (Gherardi et al., 2009). A successful federal invasive species eradication project was conducted by the USDA in the Saint Vincent Wildlife Refuge in Florida to remove invasive feral swine in 2012. The swine destroy sea turtle nests and eat the eggs, threatening endangered Loggerhead Sea Turtles populations. The project successfully eradicated the swine population using both trapping and lethal methods, and no documentation of disturbed sea turtle nests were recorded throughout the sea turtle nesting season that year (USFWS, 2013).

brought by fish farmers in the 1970s, escaped into local waterways and are now an enormous threat to the nation's major river systems (Minnesota Center, n.d.). The federal government has committed over $70 million to combat this highly successful invader and prevent it from spreading to the Great Lakes, where it could threaten an aquaculture industry valued at $7 billion annually (Davey, 2010). Fighting invasive species is a formidable and costly challenge. However, effective control and management efforts can help combat invasions and make progress toward the eradication of invasive species (see Case Stude 1).

2.2 Federal Invasive Species Management and Needs

Nine federal agencies are involved in the management of invasive species domestically. The National Invasive Species Council (NISC), established in 1999, provides high-level leadership on invasive species management. The duties of this sixteen-member council are to sustain and expand federal efforts to prevent, eradicate, and control invasive species, as well as restore ecosystems and other assets impacted by them (US DOI, 2017). The NISC is chaired by the Secretaries of Interior, Agriculture, and Commerce and is managed by an eight-person NISC Secretariat that oversees the council's operations. NISC members include the Administrator of the Environmental Protection Agency and the Secretaries of State, Defense, and Transportation, among others. The NISC is also supported by the Invasive Species Advisory Council (ISAC), which comprises a wide range of stakeholders—from representatives from the private sector to academics and state, local, and tribal government officials. ISAC provides technical input, information, and advice for consideration by the Council.

The DOI is the largest land managing body in the nation responsible for 65 percent of total federal land (Vincent et al., 2017). The DOI and its bureaus, such as the Bureau of Land Management, National Park Service, and Fish and Wildlife Service, are highly engaged in invasive species management. The DOI has an Invasive Species Coordinator under its Office of Policy Analysis who organizes management operations across its several major bureaus. In addition, the NISC Secretariat is also housed under the DOI and is responsible for coordinating inter-departmental planning and developing the NISC Management Plans.

The current 2016-2018 NISC Management Plan outlines priority areas of action for national invasive species management. The goals range from coordinating prioritization and reporting, to creating tools to train member agencies and promoting interagency coordination (NISC, 2016; NISC ISAC Secretariat, 2016). While this plan identifies several necessary goals (see Case Study 2), it does not require federal agencies or departments to carry out any specific actions to comply with the plan.

There have been some recent efforts to systematize coordination across various agencies on invasive species management. However, interagency coordination is carried out on a relatively ad hoc basis. For example, the NISC and the Invasive Species Coordinator, supported by several federal agencies, prepared the framework for Early Detection and Rapid Response (EDRR) for invasive species in 2016 to assess gaps, augment capacity, and coordinate funding (U.S. DOI, 2016). Still, interagency

coordination on invasive species management could be improved. In addition to the NISC Management Plan, a few departments, such as the U.S. Forest Service, have their own invasive species strategic management plans. However, it is not currently required for all federal agencies to create and implement such plans.

Case Study 2: NISC Management Plan

The NISC's 2016-2018 Management Plan outlines the following priority areas of action:

1. **Provide institutional leadership and set priorities** by developing a process to assess and coordinate NISC prioritization, and a mechanism to promote inter-agency coordination and reporting.

2. **Facilitate effective coordination and cost-efficiency** to limit the spread and impact of invasives and strengthen coordination among the Federal government and stakeholders.

3. **Raise awareness and motivate high-level actions** to mobilize the necessary policies, programs and resources. Increase awareness and education with digital media and communications platforms.

4. **Remove institutional and policy barriers** to the Federal actions needed to manage invasive species.

5. **Assess and strengthen Federal capacities** to implement the national Early Detection and Rapid Response (EDRR) framework.

6. **Foster innovation** via the creation of a framework to share tools among NISC agencies/departments and organize an Annual Innovation Summit.

3. The Amendment to the Fish and Wildlife Coordination Act

3.1 Amendment Overview

The Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661) authorizes the Secretary of the Interior to survey wildlife on federal lands and cooperate with federal, state, and private agencies in the protection, rearing, and stocking of all wildlife and their habitats. The WILD Act (see Case Study 3) proposes to add a section to the FWCA to require federal agencies to create strategic plans and carry out invasive species control and management activities on the lands they manage. The stated goal of the Amendment to the FWCA is to protect water, oceans, coasts, and wildlife from invasive species by inhibiting or reducing invasive species populations and restoring impacted areas (S. 826 - WILD Act, 2017). This legislation requires the secretaries of the nine agencies that manage federal land and water to report on their progress and also permits collaboration with other agencies or entities.

The Amendment to the FWCA addresses the invasive species problem domestically and sets out the terms that secretaries should comply with when developing plans to control and manage invasive species. This includes preventing economic as well as environmental damages caused by invasive species, such as habitat loss, often resulting from increased ecosystem vulnerability from invasions (Szyniszewska, 2007). Ultimately, this amendment presents an opportunity to address and improve several priorities delineated in the NISC's most recent national management plan.

Case Study 3: The WILD Act's Provisions

The WILD Act aims to protect wildlife and biodiversity worldwide by addressing three key problems: 1) invasive species, 2) wildlife poaching and trafficking, and 3) habitat loss. The bill includes three provisions in addition to the Amendment to the FWCA, that address these problems:

Multinational Species Conservation Acts: This provision reauthorizes the African Elephant, Rhinoceros and Tiger, Asian Elephant, Great Ape and Marine Turtle Conservation Acts. These acts support funds that award grants to help conserve these species by mitigating habitat loss, wildlife poaching, and trafficking.

Partners for Fish and Wildlife Program: This program provides technical and financial assistance to private landowners to plan, implement, and monitor conservation projects on their land. Projects aim to mitigate invasive species, restore habitat and protect wildlife.

Theodore Roosevelt Genius Prizes: This annual prize competition awards at least $100,000 for technological innovation in the following categories: 1) wildlife conservation, 2) wildlife poaching and trafficking, 3) invasive species management, 4) endangered species protection, and 5) human-wildlife conflict management.

3.2 Specific Mandated Activities

Strategic Plans

The primary goal of the strategic plans, as set out by the Amendment to the FWCA, is to achieve a maximum net reduction of invasive species populations on infested lands. The factors that agencies must consider when creating and implementing the strategic plans are: 1) employ effective control and management efforts that are least costly and cause least environmental harm, 2) prioritize projects that address high risk of introduction, establishment, or spread of invasive species, and 3) coordinate with affected states, state subdivisions, and tribes (S. 826 - WILD Act, 2017).

This amendment does not specify how much funding each agency will receive to carry out its planning and implementation, but mentions that funding will be allocated by Congress for each fiscal year between 2018-2022 (S. 826 - WILD Act, 2017). Of the funding allocated, agencies must ensure that at least 75 percent of funding is spent towards on-the-ground control and management operations. Not more than 10 percent is to be spent toward administrative costs, and not more than 15 percent towards investigations, outreach, and public awareness activities. Secretaries must report back to Congress on the use of funds 60 days after the second fiscal year of the enactment of the WILD Act (S. 826 - WILD Act, 2017).

Contracts

The Amendment to the FWCA authorizes the Secretary of a federal agency to enter a contract with any other agency, eligible public authority, or private entity to facilitate effective coordination in managing invasive species. The contract will be governed by a Memorandum of Understanding (MOU) that includes a prioritized listing of the target invasive species, an assessment of the area affected, an estimate of the expected area affected after management activities are carried out, and a description of each management technique to be carried out along with their economic costs and spatial delineation (S. 826 - WILD Act, 2017).

4. The Invasive Species Prioritization and Planning Program

Given the immense threats posed by invasive species and the mandates of the Amendment to the FWCA, the Strategic Invasive Species Prioritization and Planning Program (the Program) was designed to address some of the persistent gaps in federal management of invasive species.

4.1 Goals and Objectives

The goal of the Program is to enhance strategic planning for invasive species management and improve coordination and communication among the agencies involved. The Program aims to contribute to the overarching goal mandated by the Amendment to the FWCA to reduce the population of invasive species and the area infested by invasive species domestically.

To achieve this goal, the Program has three objectives:

1. Combat both economic and ecological damages caused by invasive species
2. Manage invasive species through feasible management techniques
3. Increase the efficiency of invasive species management by federal agencies

The Program has three main elements, which are detailed in the following sections:

1. Invasive species prioritization framework
2. Organizational structure
3. Reporting

Each of these three program elements is designed to achieve of one or more of the three program objectives, as shown in the table below:

Table 1. Each program element aligns with one or more target objectives for the program

Program Element	Target Objective
Prioritization framework	1, 2, 3
Organizational structure	3
Reporting	3

The Program covers a five-year period in accordance with the Amendment to the FWCA. However, this program design focuses solely on year one, during which the framework, staffing, and reporting elements are established so that full implementation can begin in successive years.

4.2 Invasive Species Prioritization Framework

The first element of the Program is the invasive species prioritization framework, which provides a set of methods by which federal agencies involved in invasive species management can prioritize resource allocation targeting specific invasive species. The prioritization framework consists of two stages: 1) a prioritization matrix evaluating invasive species by their economic costs and ecological costs, and 2) a feasibility study for invasive species management techniques. When the complete framework is

implemented, federal agencies can create strategic plans for invasive species management such that the invasive species that cause the most ecological and economic costs are targeted using the most effective and practical management techniques available.

Because there are currently disparate strategic plans with different frameworks, having this framework in common among all agencies will improve transparency and communication and will reduce inefficiencies resulting from strategic plan discrepancies. Simultaneously, this program framework allows for the flexibility necessary for agencies with different purposes and resources to adopt the framework in a way that is most practical and appropriate for each agency.

Stage 1: Prioritization Matrix

The NISC Secretariat will create a prioritization matrix to aid agencies in meeting the mandate to analyze both ecological and economic costs when performing strategic planning for invasive species management, making this dual consideration mandatory for all federal agencies that manage invasive species. In addition, the NISC Secretariat will design the prioritization matrix with built-in flexibility by providing a list of pre-approved metrics or methodologies for evaluating ecological costs and economic costs of invasive species. Each agency will then select and use one of the pre-approved ecological cost metrics and one of the pre-approved economic cost metrics based on which of the metrics are most appropriate with comprehensive data for the agency's target area and target invasive species.

Ecological costs of invasive species refer to damages caused by invasive species against ecological processes and biodiversity. Examples of ecological harm include a reduction in the number of different species in an area, the alteration of a habitat so that it is uninhabitable for native species, or outcompeting native species. These costs may have indirect economic costs to humans in the case of ecosystem services valuation, in which monetary values are assigned to ecosystem services of benefit to people. However, the ecological costs in the Program are intentionally not limited to costs to humans, because that is captured more in the next dimension of the prioritization framework—economic costs.

There are multiple ways of measuring the actual or anticipated ecological costs from invasive species. These methodologies include the Invader Relative Impact Potential (RIP), the Global Invader Impact Network (GIIN), the Invasiveness-Impact Score (I_i), and the Invasive Alien Index (IAI) (Dick et al., 2017; Barney et al., 2015; Magee et al., 2010). The NISC Secretariat will review these and other metrics of ecological costs from invasive species in order to approve a set list of metrics from which federal agencies can choose.

Economic costs of invasive species refer to economic losses resulting from damages caused by invasive species, whether that be through direct loss or the cost of repairs and maintenance. For example, economic costs occur when invasive species clog water infrastructure, harm local livelihoods that depend on native species' populations, overrun popular native species and decrease tourism revenues, or damage forests and agricultural land.

These economic costs can be quantified through various methods. For example, the economic costs could be quantified as the monetary value of ecosystem services that support human economic activity, lost as a result of invasive species, using either the Millennium Ecosystem Assessment (MA) or The Economics of Ecosystems and Biodiversity (TEEB) model (Zakri and Watson, 2003; TEEB, 2010). Other economic cost metrics focus on specific water or land uses, regions, and types of invasive species (National Invasive Species Information Center, 2017). As with the ecological cost metrics, the NISC Secretariat would review and approve a selection of economic cost metrics appropriate for federal agencies to use in the prioritization matrix.

Below is a simplified visual representation of the prioritization matrix, with ecological costs along the horizontal axis and economic costs along the vertical axis. For each cost type, categories are listed as low, intermediate, and high. Each of these categories represents how a specific invasive species would be valued for ecological and economic costs.

The actual cost values produced by a specific metric may be in the unit of dollars, percentage, number of species impacted, or another unit of measure. To compare the values from different unit types, the values for each metric can be placed on a continuum from low to high cost. Following guidance from the NISC Secretariat and Invasive Species Coordinator, federal agencies will use the matrix to combine the two cost values into one. For example, an invasive species with a high ecological cost and a high economic cost would result in a high-high cost value, represented by the lower right corner of the matrix below. Similarly, an invasive species with a high ecological cost and an intermediate economic cost would result in a high-intermediate cost value, represented by the middle square in the right column in the matrix below.

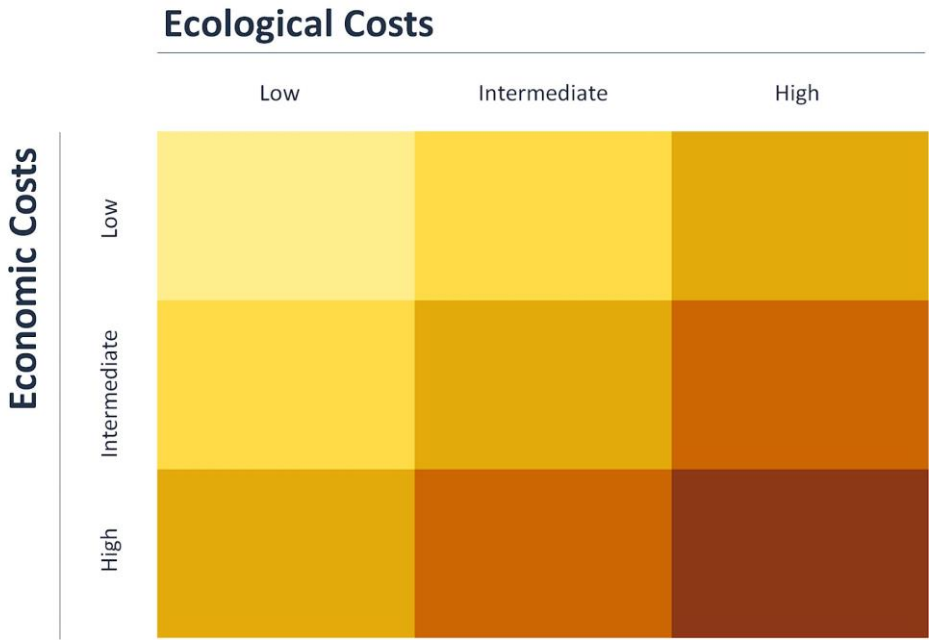

Figure 1. Visual Representation of the Prioritization Matrix

After applying the metrics for measuring ecological costs and economic costs to invasive species and combining those cost values through the prioritization matrix, agencies can then compare the relative combined costs of invasive species against one another. Agencies can then prioritize allocation of limited resources toward those invasive species with higher combined cost values. Note that the combined cost values do not result in a recommendation to allocate all resources or no resources to any specific invasive species, but instead provide a method to compare relative costs and therefore identifying relatively higher and lower priority invasive species for management. Therefore, strategic plans for invasive species management can allocate resources in a proportionate manner accordingly. However, before the strategic plans are designed, the agencies must complete the next stage in the prioritization framework.

Stage 2: Feasibility Study

Feasibility refers to the practicality of a method of invasive species management for a specific invasive species. The feasibility study considers several factors including the cost-effectiveness of a given method, the likelihood of achieving successful control or eradication, and if the method is locally applicable and politically acceptable. It also considers the resources and capacity needed to carry out the given management approach. A feasibility study evaluates each of these aspects for multiple invasive species management methods to recommend which options would be best suited. It can also help identify gaps in existing available management methods.

The NISC Secretariat provides criteria for what each agency needs to include within a feasibility study, along with a list of resources vetted by the NISC Secretariat. Each agency will select which of these resources to use when performing its feasibility study, to evaluate the feasibility of management techniques best suited to the agency's resources and target area.

4.3 Organizational Structure

The implementation of the first two stages of the Amendment to the FWCA require a high degree of coordination, which can be achieved through a three-tiered organizational structure, including guidance, planning, and implementation (see Figure 2). The guidance tier includes the NISC and the Invasive Species Coordinator, both of which are housed under the DOI. Of the NISC's members, nine are responsible for managing invasive species on domestic land and water. The NISC will be the coordinating authority that develops the combined economic and ecological prioritization framework with support from the Invasive Species Coordinator. The Coordinator will also be responsible for overseeing and managing the application of the prioritization framework among the five land management bureaus within the DOI.

The planning tier includes the nine federal agencies responsible for the management of land and water domestically. In the implementation tier, the agencies are responsible for coordinating with the respective state governors or federally recognized tribe leaders, their political subdivisions, and/or any private entities to carry out the management efforts. As mentioned above, the Amendment to the

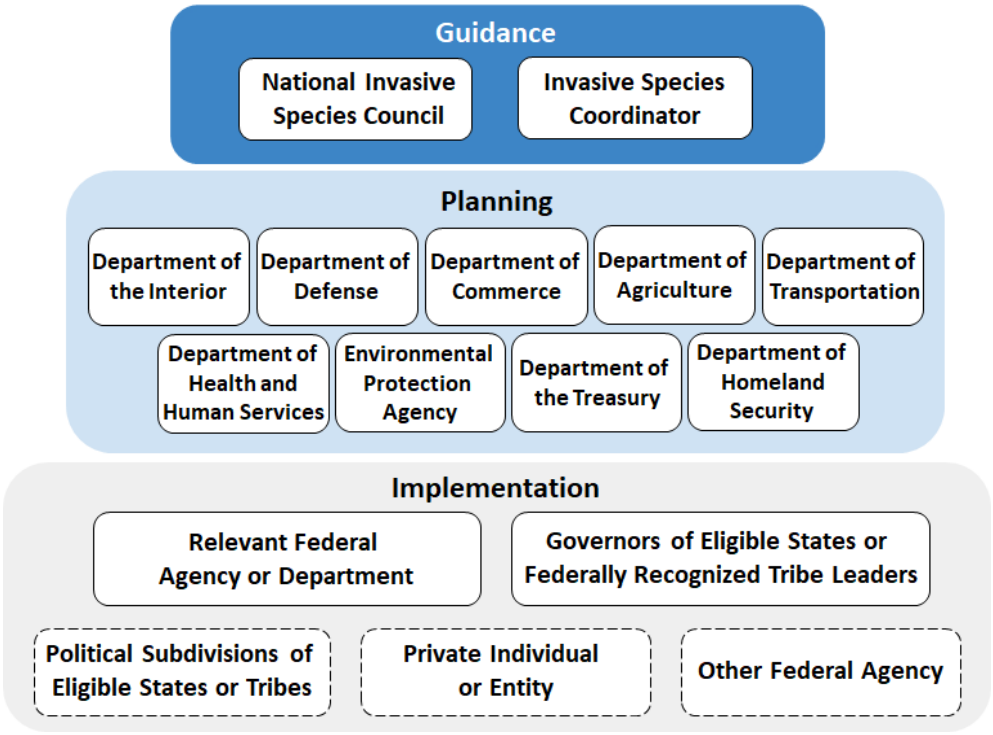

Figure 2. Diagram of the three-tier organizational structure for the Program.

FWCA authorizes the agency Secretaries to sign a contract with any other agency, eligible public authority, or private entity to implement the strategic plans. These entities are therefore included in the implementation tier.

4.4 Reporting Processes

The last element of the Program is reporting, which addresses the third program objective of increasing the efficiency of invasive species management by federal agencies. Year one activities include the creation of the mechanisms for this reporting. However, the actual reporting will not occur until the second year. Reporting occurs at two stages in the program process: 1) before strategic plan implementation and 2) during and after implementation of a strategic plan.

Reporting Stage 1: Before Strategic Plan Implementation

This reporting stage consists of a report from the federal agencies that manage invasive species (the Planning Tier) to the NISC Secretariat (the Guidance Tier). After receiving and reviewing a report, the NISC Secretariat will give feedback to the federal agencies to improve their strategic plans. This reporting stage occurs after the NISC Secretariat finishes development of, distribution of, and training on the Prioritization Framework; after strategic plan creation by the federal agencies managing invasive species; but before agencies implement their strategic plans. In this stage, each federal agency's report will include:

1. Prioritization matrix results, indicating which pre-approved metrics the agency selected

2. Feasibility study of management techniques for the species identified in prioritization matrix results
3. The agency's own not-yet-implemented strategic plan for invasive species management as guided by the prioritization matrix and feasibility study results

The NISC Secretariat will review each report to ensure that the strategic plans comply with the framework requirements in pursuit of the Program's objectives. By receiving and evaluating reports from multiple federal agencies during the same time period, the NISC Secretariat will be able to compare multiple agency plans simultaneously to identify opportunities to increase agency collaboration, to streamline management, to reduce plan redundancies, and to identify areas needing further research.

Reporting Stage 2: During and After Strategic Plan Implementation

This stage consists of a report of information collected by each federal agency about the implementation of its strategic invasive species management plans. The NISC Secretariat will receive these reports and provide feedback to those same federal agencies, which in turn adjust their planning and implementation techniques on the ground in accordance with the NISC Secretariat's feedback. The federal agencies that manage invasive species will submit these implementation reports periodically, both during and after strategic plan implementation. Each agency will report its results to-date of its implemented plans, including economic costs, personnel costs, progress toward each objective of reducing invasive species harm, and additional practical information. The purpose of these reports is so that the NISC Secretariat - in reviewing the reports - will provide further guidance for federal agencies to improve their strategic planning, to re-prioritize

Case Study 4: Coconut Rhinoceros Beetle

In 2013, the Department of Defense (DOD) discovered an invasive species on Joint Base Pearl Harbor-Hickam in Honolulu, Hawaii — the Coconut Rhinoceros Beetle. This invasive pest, native to Southeast Asia and Africa, bores holes into the crowns of coconut and other palm trees, often causing widespread tree mortality. Dead, unstable trees pose a safety hazard to those training on the base and reduce training realism (DOD, 2017). The DOD acted by cutting down infested trees, eliminating breeding sites and managing plant debris. However, If the DOD was required to prepare a strategic plan for invasive species management utilizing the proposed framework, and considering previously explored options, it may alter its approach to also consider the ecological and economic impacts of the beetle.

Palms play an important role in Hawaii's ecosystem, nursery industry, and tourism economy, and are valued for their cultural importance (Melzer, 2015). The DOD could coordinate with regional entities concerned with these issues as well as federal agencies, such as the FWS, that also list the beetle as a priority species. Conducting a feasibility study would also allow the agency to better evaluate and select effective management and control methods. Furthermore, the reporting process incorporated into the Program would allow the DOD to receive feedback and guidance from the NISC. Overall, this program has the potential to enhance efforts to combat the beetle and expand efforts beyond the DOD's base to combat this species.

resource allocation, if the level of harm caused by an invasive species changes, to update implementation techniques with current best practices and new research, and to update feasibility studies based on the effectiveness of implemented management techniques. See Case Study 4 for an example on the application of the prioritization framework and reporting process.

5. Year One Program Implementation Plan

5.1 Proposed Staffing Plan

The NISC Secretariat currently has a staff of eight employees, and the Invasive Species Coordinator is a stand-alone position with the authority to coordinate invasive species management across the DOI's bureaus. Each federal agency or bureau responsible for creating and implementing strategic plans will be required to appoint at least one policy liaison to the NISC Secretariat and, in the case of the DOI's bureaus, to the Invasive Species Coordinator.

Given the first year goals of the Program and the current, limited capacity of the NISC Secretariat and Invasive Species Coordinator, two additional staff will be added within the first year of the authorization of the Amendment to the FWCA (Figure 3).

The **Project Manager**, reporting to the Secretariat's Assistant Director of Policy and Program Coordination, will support the Assistant Director in the development and application of the framework and coordinate with the liaisons from agencies outside of the DOI throughout the planning, implementation, and annual reporting processes.

The **Program Planning Liaison**, reporting to the Invasive Species Coordinator, will work to ensure the DOI's applicable bureaus carry out strategic planning appropriately with guidance from the NISC, and report back on their progress to the Invasive Species Coordinator and NISC.

The new staffers should have at least five years of high-level policy experience on invasive species management, in addition to strong project management and communication skills, as they will be contributing to inter-departmental communication throughout the planning and reporting processes.

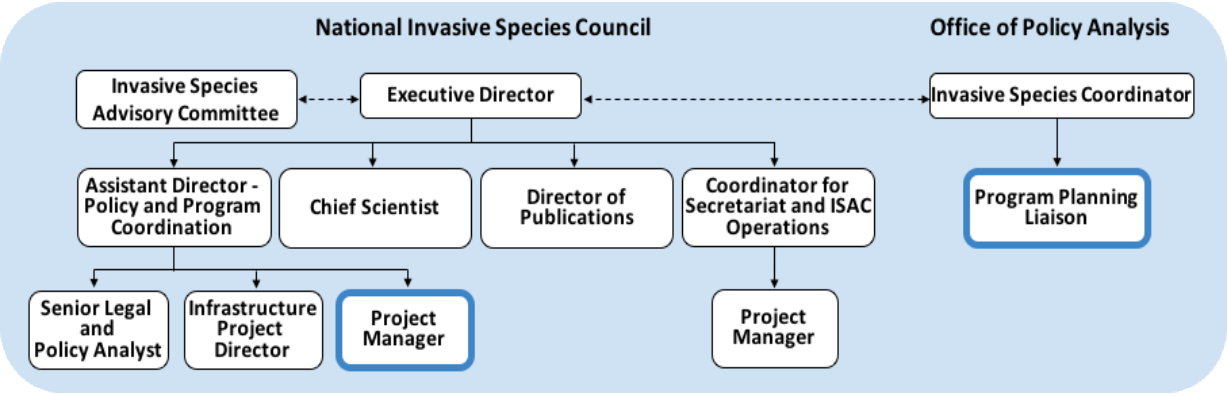

Figure 3: Organizational chart for the DOI's NISC Secretariat and Office of Policy Analysis. New positions are outlined in blue.

5.2 Program Budget

The proposed budget plan estimates $749,000 is needed to meet the year one goals of the Program, leveraging $541,000 from existing staff resources and requesting an additional $208,000 of incremental funds. Funding has not yet been allocated for the Amendment to the FWCA, but the bill delineates the percentage of funds that will be divided between administrative costs, public outreach, and on-the-ground invasive species control, which are up to 10%, up to 15%, and at least 75% respectively. The program budget solely reflects administrative costs, as the first year does not include invasive species control or public outreach.

The Congressional Budget Office (CBO) estimates the total budget for the WILD Act will be $607 million, of which approximately $500,000 is needed to implement the planning and reporting parameters of the Amendment to the FWCA from 2018-2022 (CBO, 2017). The proposed program budget for year one falls within this estimate, with nearly $300,000 available for subsequent years. In general, is important to note that the additional $208,000 required for implementation of the program design is miniscule in comparison to the overall budget of the WILD Act. In fact, the $500,000 estimate provided by the CBO is not even included in their estimated outlays summary table, with units in millions of dollars, or in the $607 million final finding.

The tasks to be completed by both the existing and new staff are categorized by: 1) Research and Assessment of Existing Programs; 2) Development of Prioritization Framework for Strategic Plans; 3) Reviewing, Reporting, and Reprioritization, and; 4) Interagency Communication. The development of the prioritization framework makes up the bulk of the tasks as this is the focus for the first year of the program (see programmatic budget in Appendix A).

The line item budget below specifies the total costs for the personnel and other than personal services (OTPS) for existing and incremental capacity for the first year. The estimated personnel costs for the eight existing NISC Secretariat staff positions and the Invasive Species Coordinator totals $494,000 and will require the work of 4.8 full-time equivalent employees (FTE) (see Appendix B). The new staff positions will devote 100 percent of their time to the project, requiring 2 FTEs. The personnel costs for the new Project Manager and Program Planning Liaison were calculated by comparing the skills and qualifications required to existing federal positions. The U.S. Office of Personnel's General Schedule (GS) Pay Scale for the Project Manager is between $55,000 - $75,000, or GS-11 and GS-12, and between $45,000 - $56,000, or GS-9, for the Program Planning Liaison (U.S. Office of Personnel, 2017). For OTPS, the new staff positions will require frequent travel to meet with invasive species management experts and practitioners at the regional and local level to help share information and inform the development of the prioritization framework.

Table 2. Line item budget for year one, specifying existing resources and incremental resources.

Line Item Budget	In $1,000
Personnel	**671**
New Staff Positions	177
Existing Staff Resources	494
Travel	**72**
New Resources	26
Existing Resources	46
Supplies	**2**
New Resources	1
Existing Resources	1
Equipment	**4**
New Resources	4
Existing Resources	0
Subtotal New Resources	**208**
Subtotal Existing Resources	**541**
Total	**749**

5.3 Performance Management and Measuring Success

In order to ensure efficient and effective implementation of the year-one goals, the Program includes a performance management system that addresses four major dimensions:

- *Measurement*: Measure quality of outputs, efficacy of implementation structure, and progress towards year-end goals.
- *Collection*: Collect performance management data from each agency or department.
- *Reporting*: Report on performance measures to evaluate needed modifications to processes.
- *Feedback*: Create feedback mechanisms whereby upper management can modify processes to improve quality of outputs and program design structure.

Measurement includes the evaluation of performance information on research, communication, and outputs produced. For example, research performance would assess the tasks performed to acquire necessary background knowledge to meet

milestones, such as the analysis of existing invasive species management programs.

Collection of performance information is completed by the two project managers within the NISC Secretariat. Collection of certain information will be linked to the completion of specific tasks and will therefore been done in chronological order, per the Master Calendar. Other information will be collected at the start of implementation and then updated periodically as the program develops.

Reporting includes the communication of performance data with department directors via email or meetings. Department directors will send memos to the NISC Executive Director monthly to report performance information, which will be evaluated against a set of criteria established by the Executive Director at the start of the Program.

Feedback is provided by the NISC Executive Director based on evaluations of performance data, and will identify any areas requiring improvement. This feedback may be communicated during meetings or via memos. In addition, feedback from department or agency liaisons and across the NISC may also be considered by the Executive Director and incorporated into programmatic changes.

See Appendix D for a sample questionnaire for performance management.

5.4 Program Calendar

The master calendar divides the first year into five discrete phases, which proceed chronologically with a few cases of overlapping tasks. The full calendar is provided in Appendix C. The calendar runs through weeks 1-50, with two weeks of contingency built-in to account for unforeseen delays.

Phase 1 - *Goal Setting, Planning and Delegation (weeks 1-18):* In this phase, the NISC will align on high-level goals with Secretaries of federal agencies, develop a workplan, and delegate existing staff as well as develop, advertise, and hire two new staff positions to ensure that all of the tasks that will be completed throughout the year are thoroughly planned.

Phase 2 - *Research and Assessment of Existing Programs (weeks 9-24):* In this phase, existing information about invasive species management techniques and operations that are already ongoing will be gathered and reviewed, so that it can be incorporated into the ultimate design of the framework. At the end of this phase, a mid-year status report will be submitted to Secretaries.

Phase 3 - *Development of Framework for Strategic Planning (weeks 25-39):* This phase includes the majority of the research necessary for framework development, including a literature review of metrics for measuring the economic and ecological harm done by invasive species and of techniques already utilized for invasive species management along with their efficacy and cost-effectiveness. Travel to field sites where management is ongoing and consultation with outside experts on invasive species are also included in this phase, which culminates with the consolidation of the phase 2 and 3 research efforts into a draft framework document.

Phase 4 - *Reviewing, Reporting, and Reprioritization (weeks 40-49):* This phase opens with a one-month comment period on the draft framework for federal agencies to share their inputs, which will be incorporated to create a final draft of the framework to send to the Secretaries.

Phase 5 - *Framework Dissemination (weeks 45-50):* In the final phase, liaisons in each agency are trained to use the framework and introduce it to their agencies. The NISC continues to be a resource to provide ongoing consultation as needed. The five phases are illustrated below in Figure 4.

Gating Tasks and Milestones

There are many discrete tasks that must be completed over the year, but there are some particularly noteworthy "gating tasks," or tasks that, if left incomplete, prevent the completion of subsequent tasks and jeopardize the on-time completion of the guidelines. These gating tasks form a critical path through the year that must be prioritized in order to keep the implementation of the program design on schedule.

Gating Tasks and Milestones:

- *Week 3-18*: At week 3, seek approval from federal Human Resources; new staff start by week 18.
- *Week 8*: Finalize goals; delegate existing staff, including appointment of liaisons from agencies.
- *Week 14*: Liaisons submit to NISC information on existing operations of agencies on invasive species.
- *Week 24*: Complete milestone mid-year report with assessment of existing invasive species programs.
- *Week 34*: Complete first draft of metrics and guidelines.
- *Week 39*: Share draft framework with liaisons.
- *Week 40-43*: Comment period for federal agencies.
- *Week 48-49*: Adopt final framework. Organize full-day training with liaisons.

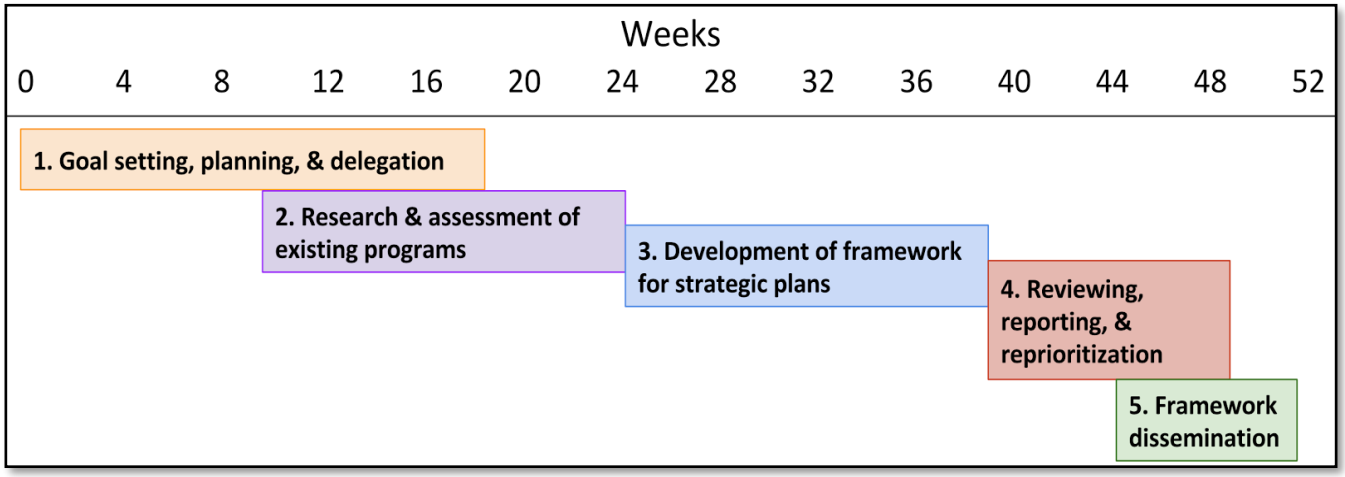

Figure 4. The five major phases for the first year of the Program.

6. Political Context and Feasibility

The Program's elements and year one plan discussed above propose a comprehensive program design for the Amendment to the FWCA. In addition to outlining an implementation plan, an assessment of this legislation in a broader political context is useful in considering the feasibility beyond its design. The passage of the Amendment to the FWCA is contingent on several factors. As mentioned above, this amendment is one of four provisions included in the WILD Act, which was introduced in the Senate by Senator Barrasso (R-WY) in April 2017. The bill passed in the Senate in June 2017 by unanimous consent and has been introduced into the House. While the WILD Act has gained bipartisan support in Congress and from several interest groups, there are certain concerns regarding the current political climate that may impact the implementation of this legislation. Furthermore, there are a few issues of debate specifically pertaining to the Amendment to the FWCA.

First, it is important to consider the current administration's position toward environmental policy and overall influence on the nation's political climate. President Trump has made several policy decisions, such as withdrawing from the Paris Agreement and cutting the EPA's budget, which do not support environmental progress. Although the WILD Act does not address the heavily politicized issue of climate change, the fact that it is environmental legislation may impact its passage. In addition, the Trump administration reversed the Obama-era import ban on ivory, which strongly opposes the WILD Act's efforts to protect endangered species and global biodiversity.

Second, there are controversies surrounding both the labeling of invasive species and the costs and benefits they may cause. Contrary to popular belief, all "alien" or non-native species are not necessarily harmful. Some scientists posit that hasty decisions are made in labeling a non-native species as harmful before thoroughly examining their impacts due to their negative reputation. There are examples of invasive species that produce positive conservation benefits by providing food and shelter for native species. The invasive zebra mussel, for example, removes toxins from aquatic ecosystems and could be used as tool for the restoration of eutrophic shallow lakes (Schlaepfer, 2011). There are also debates among conservationists on whether an invasive species should be eradicated if it is considered endangered in its native ecosystem. Invasive species can also positively impact humans, especially in low-income communities where invasives are incorporated into local livelihoods as a source of food and resources (Pejchar, 2009).

The Program's proposed prioritization framework aims to help balance the opposing viewpoints on invasive species management by considering feasibility as well as economic and ecological costs. A program design focused solely on economic costs might be politically favorable among some groups, but would likely face opposition among others, such as environmentalists, and vice versa. Therefore, the proposed prioritization

framework includes features that should be attractive to a wide range of stakeholders. The Program also creates a unifying framework that will be implemented across federal departments and agencies, which helps ensure stronger cooperation. This aggregated political leverage allows the Amendment to the FWCA to provide desirable political feasibility in the context of innovative invasive species management. Although there are some obstacles moving forward, this amendment has potential to gain sufficient political support.

7. Conclusion

The Amendment to the FWCA addresses the growing problem of invasive species and their adverse impacts on the nation's wildlife, natural resources, and economy. By requiring federal agencies to create and implement strategic plans to manage invasive species, this amendment serves to advance national efforts to reduce populations of invasive species on federal lands. The Program presented in this report provides a comprehensive strategy to enhance invasive species strategic management planning and to improve interagency coordination. The Program aims to support the national strategy to reduce invasive species populations and to restore areas impacted by invasives.

The proposed prioritization framework serves to help the nine federal agencies that manage land and water domestically better assess and plan invasive species management projects. It empowers agencies to create more effective and targeted strategic plans that incorporate feasibility as well as economic and environmental costs. The Program also supports the development of a better coordinated strategy to improve communication and collaboration both between the NISC and federal agencies, as well as among regional and local levels. Lastly, the reporting mechanism provides high-level guidance and feedback before, during, and after project implementation to better ensure success. These combined efforts offer a set of tools to support and improve federal invasive species management.

Due to the complexity of invasive species management and the global scale of this problem, addressing invasive species is a formidable challenge. The Amendment to the FWCA takes small steps to mitigate the threats posed by invasive species domestically and to advance progress toward effective invasive species management. The Strategic Invasive Species Prioritization and Planning Program works toward helping facilitate incremental, meaningful change that contributes to the WILD Act's overarching goal to protect and maintain global biodiversity.

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Acronyms

DOD: Department of Defense

DOI: Department of Interior

EPA: Environmental Protection Agency

ISAC: Invasive Species Advisory Committee

FTE: Full Time Equivalent

FWCA: Fish and Wildlife Coordination Act

FWS: U.S. Fish and Wildlife Service

MOU: Memorandum of of Understanding

NISC: National Invasive Species Council

USDA: U.S. Department of Agriculture

WILD Act: The Wildlife Innovation and Longevity Driver Act

Definitions

Invasive species: Invasive species are non-native species that cause, or are likely to cause, harm to human health, the environment or the economy (S. 826 - WILD Act, 2017).

Non-native species: 'Non-native', 'non-indigenous', 'alien' or 'exotic' refers to a species or race that does not occur naturally in an area, i.e. it has not previously occurred there, or its dispersal into the area has been mediated by humans (Manchester and Bullock, 2000).

Ecosystem: the complex of a community of interacting organisms and their physical environment functioning as an ecological unit (DOD, 2017).

Habitat: the place or environment where an organism naturally lives and grows (DOD, 2017).

ISAC: A group of non-federal experts that advise the NISC. ISAC members include representatives of state, territorial, tribal, and local governments, as well as academic institutions, non-governmental organizations, and the private sector (DOD, 2008).

NISC: The NISC provides national leadership to prevent invasive species introduction, eradicate and control populations, and restore ecosystems damaged by invasive species. The NISC is housed under the Department of the Interior and includes sixteen member federal agencies (NISC, 2016).

Population: A group of organisms of one species that interbreed and live in the same geographic area (Simberloff, 2013).

Appendix A: Programmatic Budget

Table A1: Programmatic budget for year one for incremental resources.

Programmatic Budget - Incremental Capacity		
Category	**% of Budget**	**In $1,000s**
Research and Assessment of Existing Programs	15%	31
Development of Framework for Strategic Plan	55%	114
Reviewing, Reporting and Reprioritization	20%	42
External Agency Communications	10%	21
Total	**100%**	**208**

Table A2: Programmatic budget for year one for existing resources.

Programmatic Budget Existing Staff Resources		
Category	**% of Budget**	**In $1,000s**
Research and Assessment of Existing Programs	15%	81
Development of Framework for Strategic Plan	55%	298
Reviewing, Reporting and Reprioritization	20%	108
External Agency Communications	10%	54
Total	**100%**	**541**

Appendix B: Personnel Costs

Table B1: This chart specifies the calculations for the personnel costs for existing staff within the NISC Secretariat for the Invasive Species Coordinator. The personnel cost for each position reflects the annual salary adjusted for the amount of time dedicated to working on this program.

Existing Staff Salaries and FTE Breakdown			
Position	**% Hours Work on Program**	**Annual Salary**	**Personnel Cost**
Executive Director of the Council	0.7	$114,021	$79,815
Assistant Director - Policy and Program Coordination	0.5	$70,853	$35,427
Chief Scientist	0.9	$154,008	$138,607
Coordinator for NISC Secretariat and ISAC Operations	0.2	$50,232	$10,046
Senior Legal and Policy Analyst	0.2	$60,023	$12,005
Director of Publications	0.51	$73,566	$37,519
Infrastructure Project Director	0.3	$70,087	$21,026
Project Manager	0.74	$80,121	$59,290
Invasive Species Coordinator	0.9	$110,865	$99,779
Total	**FTEs: 4.95**	**$783,776**	**$493,512**

Sources for Salary Estimates:

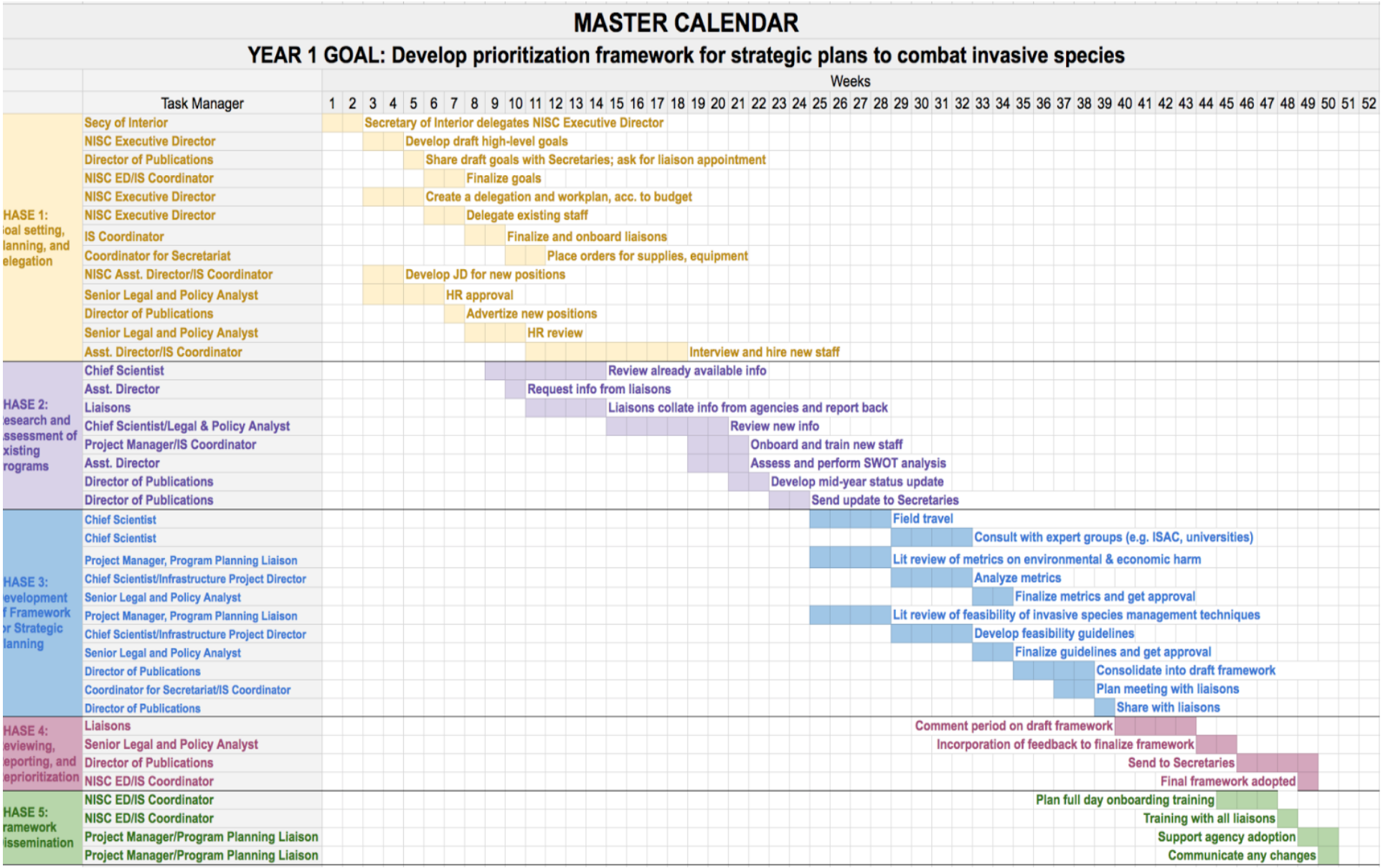
www.glassdoor.com:

Executive Director
Assistant Director
Chief Scientist
Coordinator for NISC Secretariat (Operations and Program Coordinator salary used)
Legal and Policy Analyst
Infrastructure Project Director
Invasive Species Coordinator (Deputy Director salary estimate used)
Project Manager

www.payscale.com:

Director of Publications

Appendix C: Master Calendar



Appendix D: Performance Measurement

Sample Program Performance Management Questionnaire

Research Information

1. How many existing frameworks for prioritizing invasive species management have been identified?
2. What are those frameworks?
3. How many methodologies have been identified for measuring the economic impact of invasive species?
4. For each methodology:
    a. Is it peer-reviewed?
    b. Has it been implemented?
    c. For how many invasive species is there sufficient data?
5. How many methodologies are approved for measuring the economic impact of invasive species, for use with the prioritization framework?
    a. List the names of the approved methodologies.
6. How many methodologies have been identified for measuring the environmental impact of invasive species?
7. For each methodology:
    a. Is it peer-reviewed?
    b. Has it been implemented?
    c. For how many invasive species is there sufficient data?
8. How many methodologies are approved for measuring the environmental impact of invasive species, for use with the prioritization framework?
    a. List the names of the approved methodologies.
9. Has a literature review been conducted to evaluate the cost-effectiveness and feasibility of invasive species management techniques?

Communication Information

1. How many different federal agencies were briefed on the framework creation plan?
2. How frequently do new hires meet with their direct supervisors to report on progress?
3. How frequently is the NISC Executive Director briefed on progress towards milestones?
4. How is information communicated to supervisors and NISC leadership?
5. How frequently do new hires meet with agency liaisons to share information?
6. How is information shared with Secretaries of relevant federal departments?
7. How and to whom did federal agencies provide feedback on the draft framework?
8. How does the NISC Executive Director disseminate feedback?
9. How is that feedback incorporated?

Output Information

1. Has a work plan been created and reviewed by the NISC Executive Director?
2. Have guidelines for evaluating cost-effectiveness and feasibility of invasive species control techniques been developed?
3. Has a draft of the framework been completed?
4. How many different federal agencies reviewed and gave input to revise the framework?
5. Was a revised framework created incorporating relevant feedback and research?
6. Has the Director of Publications (within NISC Secretariat) created a plan to publish the framework?