Multiple Habitats 28. Invasive and Nuisance Wildlife Removal

DEFINITION

An *invasive* or *nuisance pest* is a species that causes harm to humans or the environment (USGS n.d.). Unlike invasive species, *nonnative species* are organisms that do not occur naturally in an area but do not necessarily cause harm. Nonnative species are typically introduced to areas by humans (NPS 2020). *Nuisance species* can either be native or nonnative, but they always cause ecological or economic harm (Gwise 2021). This summary focuses on invasive animal species. Invasive and nuisance animal species can alter ecological systems and kill, suppress, compete with, or displace native species, adversely impacting biodiversity (Tu 2009). Invasive animals are present in more than half of all US National Parks (Dayer et al. 2019). Invasive and nuisance wildlife have different environmental effects and management techniques, but there are similarities in planning and implementing control and removal projects.

TECHNICAL APPROACH

Integrated pest management is one of the primary approaches for managing invasive and nuisance wildlife, and it is a sustainable and environmentally sound invasive management framework that aims to minimize the harmful effects of invasive and nuisance wildlife species (USDA 2018).

As with all invasive and nuisance species, prevention is the most cost-effective and efficient management practice for invasive and nuisance wildlife (NPS 2021). Some of the common invasive and nuisance terrestrial wildlife in the United States are brown tree snakes (*Boiga irregularis*), Burmese pythons (*Python molurus bivittatus*), European starlings (*Sturnus vulgaris*), and wild boar (*Sus scrofa*) (USDA n.d.c, Dayer et al. 2019). Some of the most common invasive and nuisance aquatic wildlife in the United States include red lionfish (*Pterois volitans*), quagga mussels (*Dreissena rostriformis bugensis*), bighead carp (*Hypophthalmichthys nobilis*), cane toad (*Rhinella marina*), Nile perch (*Lates niloticus*), and nutria (*Myocastor coypus*) (Dayer et al. 2019; USDA n.d.b). Terrestrial and aquatic invasive and nuisance wildlife can be introduced through various mechanisms, usually involving humans, and intentionally or unintentionally. Mechanisms include species intentionally imported as pets, for consumption, ornamental ponds, or research, and unintentionally by stowing aboard vessels, aircraft, and vehicles (USFWS 2020).

The steps for combating invasive and nuisance wildlife are as follows:

1. Prevention: To prevent the introduction of invasive animals, it is crucial to understand their movement and introduction potential (NPS 2021). Large-scale prevention usually relies on some form of import and export regulation, border control, and equipment inspections. Some essential prevention methods currently employed

by the Department of the Interior (DOI) include horizon scanning and predictive modeling to find high-risk species and pathways and leveraging the existing Lacey Act for wildlife trade restrictions. The DOI also prioritizes site-specific prevention measures, including educating visitors on invasive species laws (DOI 2021a).

2. Early Detection/Rapid Response (EDRR): EDRR is a method used for all invasive species taxa and involves regular site monitoring. A preplanned response is enacted when an invasive or nuisance species is detected (NPS 2021). Some key EDRR methods DOI employs include biosurveillance at high-risk sites, enhancing taxonomic expertise, and citizen science programs (Figure 1, DOI 2021a). The key emphasis of the EDRR framework is timeliness, with the idea that the quicker the species is identified and managed, the less the funding and personnel needs. EDRR is implemented through surveying and monitoring lands and responding with species- and site-specific eradication methods to prevent long-term establishment (DOI 2016).

Figure 28.1 Inspecting a recreational boat for invasive quagga mussels



Note: Boater education is a key part of preventing mussels from spreading between waterways. Photo courtesy Oregon State University

3. Long-term control and eradication: When the first two methods are not successful, and depending on the site and the level of establishment, sometimes complete eradication is not possible. Long-term control and eradication tactics are more expensive than prevention and rapid response (NPS 2021). Some methods for management and eradication include traps, shooting, toxicants, dogs, introduced predators, habitat manipulation, and barriers. The technique depends on the specific taxa being targeted and methods are typically used in concert with one another (Witmer et al. 2007). Manual/mechanical, biological, and chemical control are the main methods employed for invasive and nuisance wildlife species. Manual/ mechanical controls can involve hunting, fishing, and trapping (Figures 2 and 3). Biological control can involve the use of sterile organisms to prevent reproduction. Chemical control can involve rodenticides and piscicides. Restoration of the land and native species is another important method that should be included in all strategies (Tu 2009).

Figure 28.2 Hunting invasive lionfish

Photo courtesy Oregon State University

Figure 28.3 US Department of Agriculture (USDA) researcher training other biologists on trapping invasive Burmese pythons in Florida



Photo courtesy USDA

OPERATIONS AND MAINTENANCE

The process of detection and prevention will need to continue over time to prevent reintroductions or reinvasions of invasive and nuisance wildlife. In some cases, long-term management will be required to contain and prevent spread.

FACTORS INFLUENCING SITE SUITABILITY

- ✓ **High-risk invasive species detected:** Management should start as soon as possible when an invasive or nuisance species is detected (DOI 2016).
- Area at risk of invasion: Management and monitoring efforts are often concentrated in areas at higher risk of invasions, often determined by identifying typical invasion pathways (DOI 2016).
- ✓ **High biodiversity:** Sites with high biodiversity are often deemed high-priority landscapes for invasive and nuisance wildlife management (DOI 2016).

- ✓ Species type: Invasive and nuisance animal management and control is extremely species-specific and requires different techniques for each individual species. The species present at the site will determine what management techniques are possible (Witmer et al. 2007).
- Access: Invasive and nuisance wildlife species often cover large swaths of land across different jurisdictions and ownerships, so management efforts can be halted if access to the land is not permitted (DOI 2016).

TOOLS, TRAINING, AND RESOURCES FOR PLANNING AND IMPLEMENTATION

						Resource Includes			
Name and Link	Resource Type	Year	Authors/ Authoring Organization	Geography	Description	Design/Construction Guidance?	Site Selection?	Monitoring Guidance?	Example Projects?
US DOI Train- ing Related to Invasive Species Man- agement	Document	2021	DOI	National	This resource provides information on training op- portunities within the DOI to inform invasive species management.	✓	✓	✓	_
A National Road Map for Integrated Pest Manage- ment	Document	2018	USDA	National	This document provides information on integrated pest management princi- ples and focal landscapes for the different federal agencies.	•		•	
US DOI Fund- ing Guide for Invasive Spe- cies Manage- ment	Document	2022	DOI	National	This funding guide gives information on funding sources through the DOI for invasive species projects.	✓	_	_	_
Safeguarding America's Lands and Waters From Invasive Spe- cies	Guidebook	2016	DOI	National	This resource provides in- formation on implementing a national framework for early detection and rapid response.	✓	•	✓	✓

						Includes		
Name and Link	Resource Type	Year	Authors/ Authoring Organization	Geography	Description	Design/Construction Guidance?	Site Selection?	Monitoring Guidance?
EDDMapS	Webpage	2005	University of Georgia	National	This webpage allows people to report invasive species, monitor current distribution, learn about management methods, and get species information.	✓	✓	✓
Assessing and Managing In- vasive Species within Pro- tected Areas	Document	2009	The Nature Conservancy	National	This guide provides informa- tion on managing invasive species for biodiversity within protected areas. This guide is meant for practi- tioners.	✓	~	~
Invasive Spe- cies: Alaska	Website		Alaska Depart- ment of Fish and Game	Alaska	This website provides infor- mation on invasive species within Alaska and how to manage, prevent, and report them.	✓		✓
DOI Inva- sive Species Strategic Plan 2021-2025	Document	2021	DOI	National	This document provides in- formation on DOI's plans for invasive species manage- ment throughout the differ- ent bureaus and agencies.	✓	✓	✓
Invasive Spe- cies List	Website	Updated 2022	USDA National Invasive Spe- cies Informa- tion Center	National	This website provides a list of registered invasive spe- cies within each state and the regulations accompany- ing them.	✓	✓	
Cohesive Ap- proach for In- vasive Species Management in the North- east US	Guidebook	2007	USDA Forest Service	Northeast- ern Unit- ed States (20 states bounded by Minnesota, Maine, West Virginia, and Missouri)	This guide is meant to help facilitate collaboration, cre- ate management plans, and conduct targeted actions plan for invasive species in the northeastern US.	✓	_	•
Aquatic Nui- sance Species Task Force: 2020 - 2025	Document	2020	Aquatic Nui- sance Species Task Force	National	The plan outlines govern- ment agency strategies to address invasive and nui- sance aquatic species.	✓		✓

Resource

Example Projects?

√

 \checkmark

Multiple Habitats: 28. Invasive and Nuisance Wildlife Removal

Strategic Plan

456 | Department of the Interior Nature-Based Solutions Roadmap

LIKELY BENEFITS AND OUTCOMES

Primary objectives for each strategy are highlighted.

Social and Economic

- **Public health and safety:** Invasive and nuisance species can threaten the safety of both employees and the public within federal lands, so management can provide safer conditions (NPS 2022).
- **Food security:** Invasive and nuisance animal species consume crops, both in field and storage, and livestock. Management efforts can protect these resources and aid food security (Witmer et al. 2007).
- **Jobs:** Invasive species management requires trained site-specific personnel. From 2019 to 2021, the US Fish and Wildlife Service (USFWS) increased the number of teams working on invasive species projects from five to 14. This job increase is one example of the job growth possible with effective invasive species management (USFWS n.d.).
- **Reduced or avoided costs:** Some economic benefits of invasive species management include protecting biodiversity, reducing crop and timber damage, and enhancing ecosystem health. Invasive species management can also reduce diseases. Cost-benefit analyses are essential to ensure the reduction or avoidance of costs (Hanley and Roberts, 2019).
- **Recreational opportunities:** Invasive and nuisance animal species have diminished national parks' recreational value, so effective management can preserve these recreational resources and areas (Dayer et al. 2019).

Ecological

• **Enhanced biodiversity:** Invasive and nuisance species are one of the leaders in biodiversity loss, native species endangered status, and species extinction. Management can help reduce biodiversity loss from these species, and restoration in management practices can enhance native biodiversity (IUCN 2021, Tu 2009).

BARRIERS AND SOLUTIONS FOR PRACTITIONERS

Common Barriers

Several barriers are common across many of the nature-based solutions strategies; these are described in more detail in Section 1 of the Roadmap. Additional notes about the barriers specific to invasive and nuisance wildlife removal are included here.

• **Expense:** In 2022, DOI allocated \$18,525,500 toward invasive species management projects (USDA n.d.a). Funding opportunities for invasive and nuisance species management are often focused on plants, insects, and pathogens, so funding opportunities for invasive and nuisance wildlife can be challenging (Witmer et al. 2007).

- **Capacity:** One of the main challenges for invasive and nuisance animal species management is limited capacity and resources. Management is challenging because invasive species are often not dealt with until their impacts are obvious, which implies widespread establishment and requires many more people to manage. To avoid personnel limitations, it is important to have trained managers focus on prevention and EDRR efforts (Dayer et al. 2019).
- **Public opinion:** Invasive and nuisance wildlife management typically receives less funding than plants, insects, and pathogens. Public perception surrounding invasive and nuisance animals is not as strong, and there are more reservations about managing animals if the management is perceived as hurting the species. Education is crucial to gain the support of the public (Witmer et al. 2007).

• Conflict with other land uses

- Regulation
- Lack of effectiveness data

Community

- **Safety:** Invasive and nuisance animals can bring safety hazards to people and domestic animals, so management can be dangerous. It is essential to be cautious when managing for these species (Witmer et al. 2007).
- **Exotic pets:** Invasive and nuisance wildlife species are often legally introduced to the United States as exotic pets. This enormous industry can make management challenging (Witmer et al. 2007). An example of an invasive species introduced through the exotic pet trade is the Burmese python in Florida (Janos 2018).
- Access: Because of the nature of invasive and nuisance wildlife, management is often required across large land areas across various jurisdictions and ownerships. Accessibility and regulations across land areas can vary, making large-scale management challenging (Witmer et al. 2007).

Ecological

• **Chemical use:** Chemicals like rodenticides can be very toxic to humans and the environment. Rodenticides can be ingested by nontarget wildlife, which negatively impacts biodiversity. The EPA has regulated certain chemicals, and it is important to avoid chemical control as much as possible (Center for Biological Diversity n.d.).

EXAMPLE PROJECTS

Name and Link	Location	Leading Organizations	Techniques Used	Size	Cost	Duration	Project Description	Climate Threats Targeted	Lessons Learned or Adaptive Management
Palmy- ra Atoll National Wildlife Refuge Rat Eradication Project	Palmyra Atoll National Wild- life Refuge	US Fish and Wildlife (USF- WS)	Chemical control using various ro- denticides	618 acres of land and 15,512 acres of lagoons and shallow reefs	Not provid- ed.	Ongoing (began 2011)	This project aims at reducing rat pre- dation on seabirds specifically, as well as plants and ter- restrial vertebrates. The project aims to preserve biodiver- sity and reduce a nonclimate stress- or from the island ecotype.	Enhancing biodiver- sity	Invasive coco- nut trees took over after rats were eradi- cated, so the USFWS had to continue forest invasive management. Continued monitoring is crucial to understanding eradication's long-term ef- fects (Hardach 2020).
Quagga-Ze- bra Mussel Action Plan for Western U.S. Waters	Western United States	The Western Regional Panel on Aquatic Nui- sance Species	preven- tion, EDRR, containment and control, outreach and education, research	Not pro- vided	Not provid- ed	Estab- lished in 2010	This project aimed to set up water regulations for the western states. The goals focused on establishing priori- ties of management actions and serving as a future road map.	Enhancing biodiver- sity, water quality	No
Chesa- peake Bay Nutria Eradication Project	Chesapeake Bay, MD	USFWS , US Department of Agriculture An- imal and Plant Health Inspec- tion Service Wildlife Ser- vices, Maryland Department of Natural Re- sources	Detector dogs, habitat modification, traps, shoot- ing, chemi- cal controls (ICWDM n.d.).	>250,000 acres	\$30 million (Fenston 2020)	>20 years	The impacts of nutria on the Ches- apeake Bay region in Maryland devas- tated marshes and wetlands as a result of their feeding pat- terns. This project aimed to protect and fully eradicate nutria through var- ious control meth- ods.	Sea level rise, en- hance bio- diversity	This project is an excellent ex- ample of how interagency collaboration is crucial for eradication projects.

Bolding indicates DOI affiliates.

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460 | Department of the Interior Nature-Based Solutions Roadmap

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Authors and Affiliations

Katie Warnell, Nicholas Institute for Energy, Environment & Sustainability, Duke University Sara Mason, Nicholas Institute for Energy, Environment & Sustainability, Duke University
Aaron Siegle, Duke University
Melissa Merritt, Nicholas School of the Environment, Duke University
Lydia Olander, Nicholas Institute for Energy, Environment & Sustainability, Duke University

Contributors

Tamara Wilson, US Department of the Interior Whitney Boone, US Department of the Interior

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