Toolkit to Address Free-ranging Domestic Cats (*Felis catus*) on Agency Lands Managed for Native Wildlife and Ecosystem Health

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ASSOCIATION *of* FISH & WILDLIFE AGENCIES

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EXECUTIVE SUMMARY

The Association of Fish and Wildlife Agencies (AFWA) developed this toolkit to provide guidance to fish and wildlife agencies as they address free-ranging domestic cats (*Felis catus*) on agency lands managed for native wildlife and ecosystem health. Topics in this document include wildlife conservation, infectious diseases, legal issues, education and outreach, human dimensions, partnerships, management strategies, and model regulatory and legal language. This toolkit is not intended to be prescriptive or to mandate any actions by agencies at the state, federal, tribal, or territorial level. Instead, this document should be regarded as a set of recommendations for agencies and other landowners to consider as they develop or revise their own programs.

This toolkit was developed with input from many wildlife conservation professionals, representing a variety of state, federal, and non-governmental partners across North America, actively engaged in this issue and AFWA Working Group. The content includes the best available peer-reviewed science and guidance based on compassion for the well-being of wildlife, native habitats, domestic animals, and people.

INTRODUCTION

Impacts of invasive species are among the leading, modern, natural resources conservation challenges. Globally, invasive species are one of the main drivers of biodiversity loss, and the associated disruption of ecosystems can undermine valuable ecosystem services (Doherty et al. 2016, Walsh et al. 2016). Invasive species in the United States alone have been estimated to cause nearly $120 billion in economic damages annually (Pimentel et al. 2005). Consequently, to manage public trust resources effectively, control of invasive species is essential.

One of the world's most harmful invasive species is the domestic cat (*Felis catus*, Lowe et al. 2000, Western Governors Association 2018). Since domestication in the Near East approximately 10,000 years ago, cats have been introduced by people to new environments across the globe (Driscoll et al. 2007, Medina et al. 2011). Where domestic cats – whether owned or unowned – have been permitted to roam the landscape (i.e., free-ranging) the consequences of these introductions have been detrimental to wildlife and the environment. In this toolkit, we use the term "free-ranging domestic cats" to refer to all domestic cats, regardless of ownership status, that are outdoors and not under the control of people.

Management of domestic cats is necessary to ensure the integrity of natural resources. The Association of Fish and Wildlife Agencies recognized this fact in a 1997 resolution, acknowledging "cat predation as an important inimical factor affecting wildlife that resources agencies are charged to manage" (AFWA 1997). Nevertheless, proportionate resources to assist agencies with this management need are not widely available.

Our objective was to develop a set of resources and recommended management practices based on the best available science to be used as a guideline for fish and wildlife agencies to effectively and appropriately address domestic cat impacts on agency lands managed for wildlife conservation and ecosystem health. We review resources on key issues, including predation of wildlife, domestic cat diseases, and legal and policy constraints, and make recommendations intended to assist agency staff.

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IMPACTS ON WILDLIFE

As obligate carnivores, domestic cats are skilled and instinctive predators that have contributed to the extinction of at least 63 species, which accounts for 26% of all bird, mammal, and reptile extinctions in the modern era (Doherty et al. 2016). In Australia, domestic cats kill an estimated 377 million birds and 1.14 billion mammals annually (Woinarski et al. 2017, Murphy et al. 2019) and are a leading cause of native mammal extinctions (Woinarski et al. 2015). In Canada, an estimated 204 million birds are killed by cats annually (Blancher 2013). In the United States, domestic cats kill an estimated 2.4 billion birds and 12.3 billion mammals each year (Loss et al. 2013). Domestic cats are the greatest direct, anthropogenic threat to birds in the United States and Canada, and their impacts are magnified by the fact that even well-fed domestic cats will hunt and kill wildlife (Blancher 2013, Loss et al. 2013, Loyd et al. 2013, Loss et al. 2015). The annual economic damage caused by free-ranging domestic cat predation on birds in the United States alone has been estimated at $17 billion (Pimentel et al. 2005).

Domestic cats may also impact wildlife through indirect effects such as competition for resources, transmission of infectious agents (viruses, bacteria, and parasites) that can cause disease directly or by environmental contamination (see **Domestic Cat Diseases**), and hybridization (Medina et al. 2014). For example, domestic cats may compete with native predators for scarce resources, especially where there is close dietary overlap (George 1974; Biró et al. 2004, 2005; Medina et al. 2014; Széles et al. 2018). Predation of wildlife may also result in trophic cascades that indirectly affect one species through competitive release of another (Hawkins et al. 2004).

Additionally, domestic cats in the environment can modify the behavior of native wildlife, and these modifications may affect conservation outcomes. Domestic cat presence may alter migratory bird habitat use on the wintering grounds and selection of nesting sites (Marks and Redmond 1994, Ratcliffe et al. 2009). Domestic cat presence may also modify fecundity through the ecology of fear (Beckerman et al. 2007). Bonnington et al. (2013), for example, observed that the mere presence of a domestic cat in the environment was sufficient to reduce the amount of food provided to chicks in the nest and increase the likelihood of predation by another predator.

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DOMESTIC CAT DISEASES

Free-ranging domestic cats present disease concerns due to the health and welfare risks to individual domestic cats and consequential impacts on the health and welfare of other animals (both domestic and wild), humans, and our shared environment. Some agencies have adopted a "One Health" approach for managing such risks. One Health is "the concept that humans, animals, and the world we live in are inextricably linked" and "the collaborative effort of multiple disciplines working locally, nationally, and globally to attain optimal health of people, animals, and the environment" (AAWV 2017, AVMA 2020). A One Health approach that accounts for linkages among humans, animals, and the environment, and promotes meaningful engagement among human and veterinary medical professionals, wildlife stewards, and land/habitat management, is warranted for managing free-ranging domestic cat risks.

Compared to domestic cats maintained indoors, free-ranging domestic cats experience higher risks of viral, bacterial, fungal, and parasitic diseases due to their free-ranging behavior and uncontrolled environmental interactions (e.g., Chalkowski et al. 2019). Domestic cat diseases may be transmitted by pathogens persisting in the environment (soil, water, air) or through direct contact, and many are also zoonotic with public health consequences. Understanding the routes of pathogen transmission of these diseases is critical to developing intervention strategies that prevent or mitigate disease exposure risks, and the table in Appendix I summarizes these relevant diseases, their common routes of transmission, and control measures.

While prevention and control measures such as vaccination, antibiotics, or topical flea and tick treatments are available for owned domestic cats that can be properly medicated, health management of free-ranging domestic cats unaccustomed to human contact can present significant challenges. Repeated attempts to capture, handle, and administer treatments, including booster vaccinations, are often unsuccessful and may pose risk of injury or disease exposure to handlers. Frequent re-exposure and reinfection of these free-ranging domestic cats by viral or bacterial pathogens and parasites in the environment further exacerbate control effort challenges.

The challenges of disease control notwithstanding, the following examples illustrate the various routes of transmission for key pathogens reported in free-ranging domestic cats to highlight suspected and known disease spillover into wildlife or zoonotic disease exposure to humans. Disease control efforts should be targeted at these interfaces.

Aerosol

Viral diseases such as type-A influenza viruses (e.g., avian, swine) and coronaviruses (e.g., SARS-CoV-1, SARS-CoV-2, feline infectious peritonitis) can be transmitted by aerosolized ocular-nasal and oral discharges or by ingestion of infected prey/food. The novel SARS-CoV-2 coronavirus, for example, has caused infections in domestic cats, and the virus has subsequently been transmitted laterally (Halfmann et al. 2020, Shi et al. 2020). Domestic cats may also be exposed through close contact with people (ProMED Archive Number: 20200422.7256272). While the susceptibility to and sustained transmission of SARS-CoV-2 in wild felids from domestic cats is not yet known, the potential warrants further investigation (AFWA 2020).

Bordetella bronchiseptica is a species of bacteria that may be found in the respiratory tracts of domestic cats with or without signs of disease. Its prevalence is much higher in domestic cats that live in dense concentrations such as catteries or animal shelters and, thus, may be particularly problematic where free-ranging domestic cats concentrate at a localized resource (Goldstein and Abrahamian 2015).

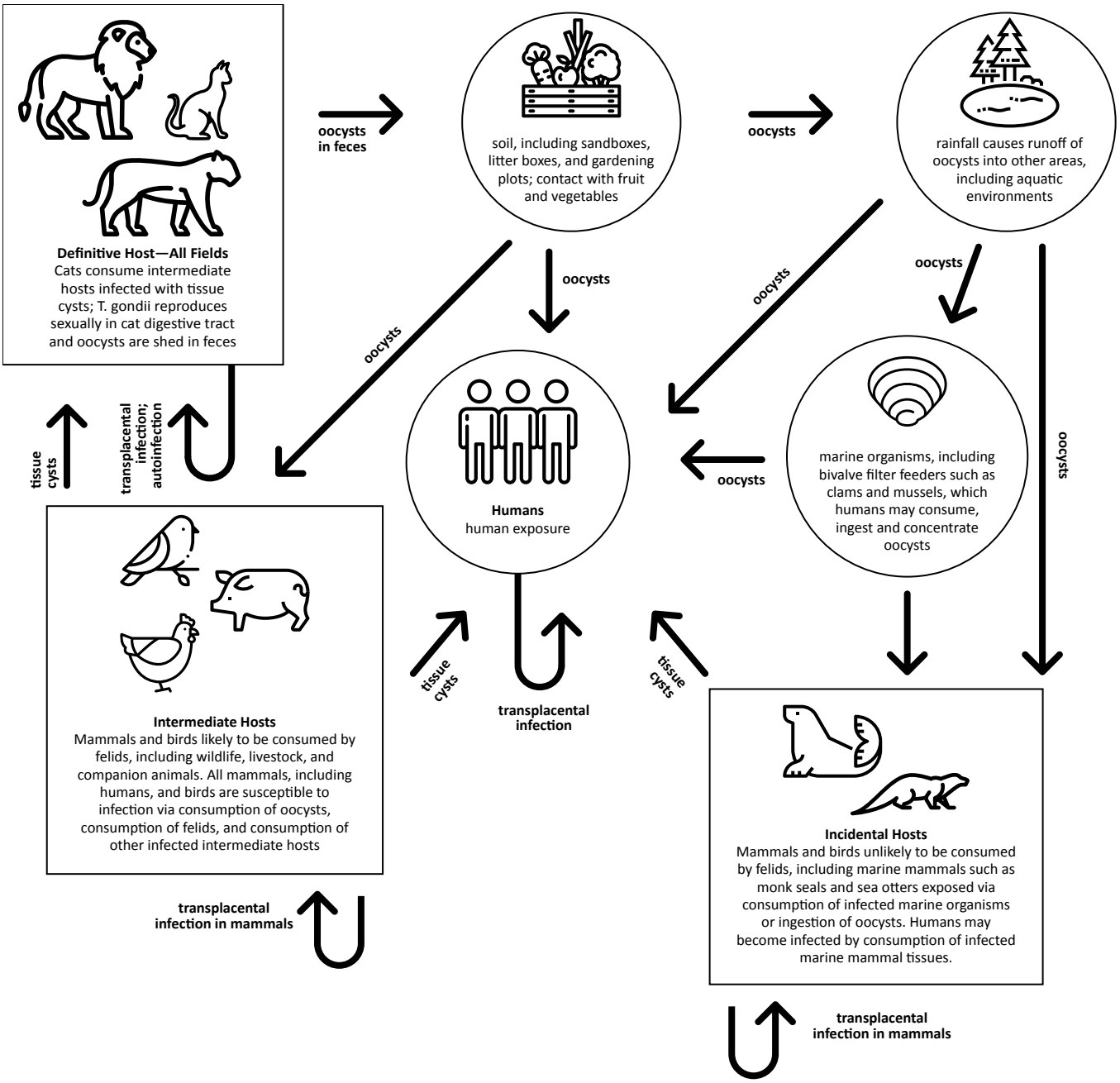
Vector-borne

Vector-borne diseases are very common in free-ranging domestic cats due to continued exposure to fleas, ticks, and mosquitoes, especially for those domestic cats without routine, preventive pesticide treatments. Plague, tularemia, bartonellosis, rickettsial diseases, and tapeworms (*Dipylidium caninum*) are transmitted by fleas (McElroy et al. 2010, Lappin et al. 2019). Ehrlichiosis, anaplasmosis, babesiosis, cytauxzoonosis, hemobartonellosis, and borreliosis (Lyme disease) are transmitted by ticks (Lappin 2018, Lappin et al. 2019). West Nile Virus is transmitted by mosquitoes, but this disease has not yet been reported in domestic cats.

Many of these vector-borne diseases may cause fatal or chronic infections in free-ranging domestic cats, and free-ranging domestic cats may expose people and other animals to the fleas and ticks that transmit these diseases (Lappin et al. 2019). Riley et al. (2004), for example, reported high seroprevalence in bobcats (*Lynx rufus*) for *Bartonella henselae* (bartonellosis) and *Toxoplasma gondii* (toxoplasmosis) in rural and urban zones in association with proximity to domestic cats and humans.

Figure 1

Life cycle of Toxoplasma gondii and transmission pathways in humans, domestic animals, and wildlife (modified from Aguirre et al. 2019). Figure used with permission from authors.



CASE STUDY

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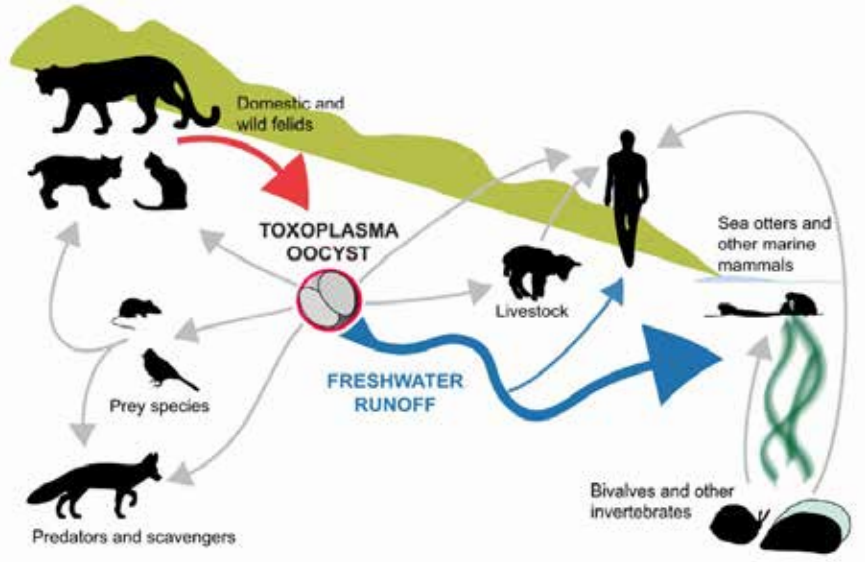
The recovery of endangered southern sea otters (*Enhydra lutris nereis*) on the California coast has been impeded by contamination of the environment with *Toxoplasma gondii* oocysts. A series of studies identified *T. gondii* infection among otters and contamination of the marine ecosystem and determined that oocysts from the terrestrial environment were flowing into the marine environment and causing otter fatalities and sub-lethal effects (e.g., Miller et al. 2002, Kreuder et al. 2003, Johnson et al. 2009, Fig. 2). Dabritz et al. (2006) determined that 44% of more than 9,000 domestic cats in one region of California defecated outside more than 75% of the time and estimated that each domestic cat deposited approximately 40 g of feces into the environment each day, potentially serving as a major route of transmission. VanWormer et al. (2013a) went on to determine that mountain lions (*Panthera concolor*), bobcats, and "unmanaged" feral domestic cats had very high *T. gondii* exposure prevalence (73-81%). Nevertheless, despite lower exposure prevalence (17%) among "managed" feral domestic cats, both managed feral domestic cats and pet domestic cats likely contributed more oocysts to the environment due to their much greater abundance (VanWormer et al. 2013a).

Figure 2

Environmental transmission pathway of *Toxoplasma gondii* from terrestrial to marine ecosystems (VanWormer et al. 2013b).



Oral

Viral diseases, such as feline infectious peritonitis, feline panleukopenia, pseudorabies, avian influenza, and SARS, are transmitted via the fecal-oral route or by ingestion of infected prey. Bacterial diseases, such as giardiasis, cryptosporidiosis, campylobaceteriosis, salmonellosis, and helicobacter, are transmitted by ingestion of contaminated feces, water, and food. Endoparasites (e.g., roundworms, hookworms) have a direct life cycle and are transmitted by ingestion of contaminated feces. Other endoparasites (e.g., tapeworms, flukes) have a more complicated life cycle requiring ingestion of prey animals serving as intermediate hosts.

Domestic cats and other felines are the definitive host of the protozoan parasite *T. gondii*, and domestic cats are a source of direct and indirect infection to themselves (auto-infection), other animals, and people (Dabritz et al. 2008, Dubey and Jones 2008, Aguirre et al. 2019). Domestic cats or other felines are necessary for the sexual reproduction of *T. gondii*, which is then excreted into the environment in the form of oocysts. Other animals (intermediate hosts) are then infected by ingesting these oocysts from contaminated surfaces or by consuming animals that have been infected (Dubey and Jones 2008, Aguirre et al. 2019, Fig. 1). Humans are primarily infected by consuming infected tissues in undercooked meat or from exposure to oocyst-contaminated environments (e.g., garden soil; Gerhold and Jessup 2013, Aguirre et al. 2019). Recent studies have found that rainfall and runoff have contributed to oocyst contamination in aquatic and marine systems, resulting in subclinical, latent, or lethal infections in wildlife (e.g., seals, dolphins, otters; Aguirre et al. 2019). The diversity of infection pathways and variety of at-risk species necessitates a One Health approach to mitigating *T. gondii* risks (Aguirre et al. 2019; Fig. 1).

Direct Contact

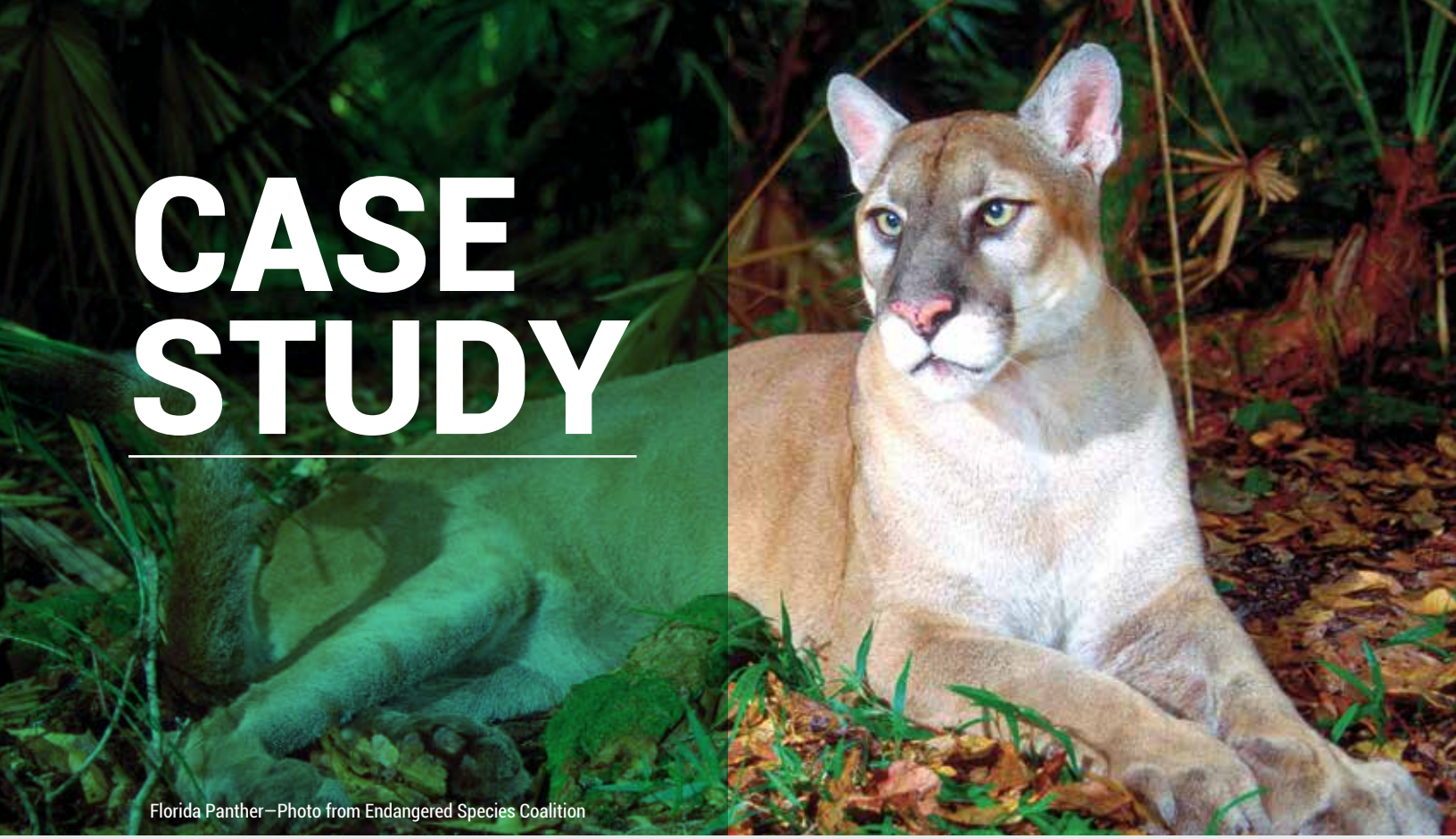
Bites, scratches, and skin abrasions are routes of transmission of viral diseases (e.g., rabies, feline leukemia virus (FeLV), feline immunodeficiency virus (FIV)), hematozoal disease (babesiosis), bacterial diseases (pasteurellosis), and fungal diseases (e.g., sporotrichosis, dermatophytosis/ringworm; Goldstein and Abrahamian 2015). Many of these diseases pose a significant public health risk and can be spread to other domestic or wild animals. Rabies, in particular, is a preventable disease by prophylactic vaccination of animals and people at risk of exposure. Approximately 5,000 animals per year test positive for rabies in the United States (Ma et al. 2020).

Although domestic animals account for less than 10% of all rabid animals in the United States, domestic cats have consistently been the top source of rabies among domestic animals in recent years and are disproportionately more likely to expose people to the disease than wildlife (Goldstein and Abrahamian 2015, Roebling et al. 2014). Multiple studies have associated human exposure with free-ranging domestic cats purposely maintained outdoors and often lacking stringent rabies vaccination adherence, which places a burden on local authorities to capture and euthanize domestic cats to protect animal and public health (Gerhold and Jessup 2013, Taetzsch et al. 2018). Any management of free-ranging domestic cats must account for these risks and follow standard veterinary practice and the National Association of State Public Health Veterinarians (NASPHV) rabies compendium guidelines, including the administration of regular booster vaccinations (NASPHV 2016).

Over the last 20 years, FeLV and antibody titers indicative of infection have been detected in Florida panthers (*Puma concolor coryi*) and other wild felids in different regions of the United States. Based on genotyping, the FeLV strains isolated from Florida panthers appeared related to virulent domestic cat strains. This relationship has often been observed when panthers are near urban-wildland interfaces where exposure to free-ranging domestic cats is likely to occur (Cunningham et al. 2008, Chiu et al. 2019). Further investigations on the source of FeLV infection in panthers provided evidence to suggest that consumption of FeLV-infected domestic cats would be an effective way to transmit the virus. During necropsies, domestic cat remains have been found in stomachs of mountain lions from California and Colorado, especially near urban locations (Jessup et al. 1993, Chiu et al. 2019). Subsequently, the virus began to spread with the mountain lion population (Cunningham 2008). Several Rocky Mountain populations of mountain lions were also found to be endemic for feline immunodeficiency virus (FIV) and feline parvovirus (FPV) based on serologic analysis (Biek et al. 2006).

The control and management of free-ranging domestic cats should be of concern to wildlife management, public health agencies, and animal welfare groups (AAWV 1996). Furthermore, wildlife managers and other animal health and welfare professionals must have situational awareness of biohazards and zoonotic diseases when performing work activities. It is important to conduct a job hazard analysis to identify potential hazards and list corresponding risk mitigation efforts, including always following personal hygiene and biosafety protocols, receiving relevant pre-exposure vaccinations (e.g., rabies), and using appropriate personal protective equipment when handling live animals and working in known or potentially pathogen-contaminated environments.

CASE STUDY



Florida Panther—Photo from Endangered Species Coalition

A strategic approach used to control the spread of Feline Leukemia Virus (FeLV) in the endangered Florida panther population was to implement targeted FeLV vaccination first on the core infected population (northern range) followed by expanding vaccination throughout the panther range, as described in Cunningham et al. (2008). An initial vaccine pilot study was conducted on three captive sub-adult panthers to evaluate any adverse reactions; none were identified. These vaccinated animals were released to their core home range. Subsequently, 52 free-ranging, FeLV-negative panthers received at least one vaccination, and 26 of those received a booster. None of the FeLV-vaccinated panthers became infected, and FeLV monitoring of the population has continued. Test-removal of FeLV-infected panthers was eventually included in the disease management plan, which had been shown to be beneficial in closed domestic cat populations. The spread of FeLV may also pose a threat to other listed cats like the jaguar (*Panthera onca*), lynx (*Lynx canadensis*), and ocelot (*Leopardus pardalis*).

European lynx in a snowy forest - www.freepik.com

Jaguar - www.pixabay.com

Governmental agencies and public or private organizations need to communicate and coordinate on how to humanely regulate and control free-ranging domestic cats on public lands managed for the conservation of native species and ecosystem health.

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LEGAL ISSUES

Legal challenges associated with free-ranging domestic cats have arisen across federal, state, and local jurisdictions and included claims regarding physical injury, threats to property, and threats to wildlife. Many of these legal claims have included the regulation of "colonies" of domestic cats as part of trap, neuter, release (TNR) programs. It will be beneficial for wildlife conservation agencies to review the cases presented below to better understand their potential legal liabilities and responsibilities relative to free-ranging domestic cat management. These cases represent an emerging legal issue.

A central theme in litigation concerning free-ranging domestic cats is whether regulation falls within a municipality's traditional responsibility for affairs that are "local in nature rather than State or national." See County of Cook v. Village of Bridgeview, 8 N.E.3d 1275, 1278-81 (Ill. App. Ct. 2014). A 2014 Illinois appellate court looked through the lens of state and county disease control and held that domestic cats are not a purely local issue. Id. at 1279. Based on the limits of the village's home rule authority under Illinois's constitution, as well as the state's and counties' historical roles in animal health and diseases prevention, the court ruled that a county ordinance permitting TNR prevailed over a village ordinance prohibiting it. Id at 1279-80. A New Mexico appellate court upheld the City of Albuquerque's TNR program against a petition for writ of mandamus because the petitioner had not exhausted her potential remedies. Britton v. Bruin, 2016 WL 1018213 (N.M. Ct. App. Feb. 22, 2016). This narrow ruling avoided deciding whether the two ordinances conflicted. Id at *5.

Responsibilities regarding natural resources are another emergent theme to filed litigation, and claims have been filed at both the state and federal levels. In one case, plaintiffs in California successfully challenged a Los Angeles TNR program that had failed to comply with the California Environmental Quality Act (CEQA). Defendants were enjoined from implementing the TNR program unless and until they had completed the required environmental review. Urban Wildlands Group v. City of Los Angeles, No. B222696 (unpublished) (Cal. Ct. App. 2d Dec. 6, 2010) (upholding the lower court's injunction on the City's operation of the TNR program until completion of CEQA review).

At the federal level, the U.S. Fish and Wildlife Service has repeatedly suggested that domestic cat impacts may be in violation of the Migratory Bird Treaty Act and the Endangered Species Act (ESA; FWS 2006, 2009, 2014). The principal case on point is a lawsuit filed by the American Bird Conservancy under the ESA against the Commissioner of the New York Office of Parks, Recreation, and Historic Preservation for facilitating the maintenance of free-ranging domestic cats at a state park on Long Island near nesting piping plovers (*Charadrius melodus*), which are a federally threatened species. American Bird Conservancy v. Harvey, 2:16-cv-01582-ADS-AKT at *6-*7 (E.D.N.Y Feb. 6, 2017) (denying the Parks Office's motion to dismiss). It is relatively uncommon for an ESA take claim to involve a state agency's inaction or omission, but the presiding judge found as follows:

> If…the Parks Office is the only entity authorized to remove the feral cats from Jones Beach, and the only entity authorized to control access of members of the public to the area to build shelters and/or feed feral cats…then the Commissioner's failure to take such measures represents the causative link needed to connect her actions and/or inactions to the Plaintiffs' harm.

Id. at *21.

The Court also found a "broad affirmative duty to take such measures as are reasonably necessary to protect threatened species within [a governmental agency's] jurisdiction." Id. at *25-*26. A settlement in 2018 resulted in trapping and removing the domestic cats at Jones Beach State Park to an offsite sanctuary and requires the ongoing removal of any new free-ranging domestic cats in the park. Am. Bird Conserv., Jones Beach Legal Settlement Provides Safety for Endangered Birds (Aug. 8, 2018), available at https://abcbirds.org/article/jones-beach-legal-settlement-provides-safety-for-endangered-birds/ (last accessed June 30, 2020).

We have summarized the relevant case law below in chronological order by decision year.

Urban Wildlands v City of Los Angeles | Filed: 2008 | Ruling: 2010
State: California
A coalition of conservation non-profits, led by The Urban Wildlands Group, sued the City of Los Angeles alleging that the City's new TNR program could not be implemented without environmental review under CEQA. The court agreed and enjoined the implementation of TNR until an environmental review had been completed.

State of Hawai'i v Krister Garcia | Filed: 2011 | Ruling: 2011
State: Hawai'i
The State of Hawai'i charged Krister Garcia with animal cruelty for shooting feral domestic cats on Maui. The defense argued that the feral domestic cats did not qualify as a "pet animal" and were not covered by animal cruelty statute. The court rejected the argument, and the defendant ultimately pled guilty.

County of Cook v Village of Bridgeview | Filed: 2014 | Ruling: 2014
State: Illinois
Cook County filed suit against the Village of Bridgeview for prohibiting feral domestic cat colonies within its boundaries despite a county ordinance that permitted TNR. The County alleged that the village's ordinance impinged upon its statutory authority. The Court agreed and enjoined the village from enforcing its ordinance.

Britton v Bruin | Filed: 2013 | Ruling: 2016
State: New Mexico
Albuquerque, NM, resident Marcy Britton filed a Petition for Writ of Mandamus against the City of Albuquerque alleging that the City's TNR policy for domestic cats violated the City's Humane and Ethical Animal Rules and Treatment ordinance and the state's animal cruelty statutes. The Writ of Mandamus was denied by the District Court because "even if the TNR program [were] illegal, other remedies were available to Petitioner short of the drastic remedy of mandamus." A Court of Appeals affirmed the decision "without deciding that the TNR program was a serious violation of the law."

Quail Village Homeowners Association v Janice Rossell | Filed: 2013 | Ruling: 2018
State: Delaware
The Quail Village Homeowners Association in Camden-Wyoming, DE, filed a complaint in the Delaware Court of Chancery against resident Janice Rossell alleging that her keeping of feral domestic cats in structures on the property violated deed restrictions regarding building structures. The Court agreed and granted injunctive relief to the plaintiffs.

ABC v Rose Harvey | Filed: 2016 | Settled: 2018
State: New York
American Bird Conservancy, a 501(c)(3) non-profit organization, sued the New York State Office of Parks, Recreation, and Historic Preservation for violating the Endangered Species Act by facilitating feral domestic cat colonies at Jones Beach State Park, which threatened piping plovers. In the court-ordered settlement, the State agreed to enclose or remove all the cats and to prohibit cat colonies in the future.

Alence v Hillsborough County | Filed: 2017 | Ruling: 2018
State: Florida
Veterinarian Ellen Alence sued Hillsborough County, FL, on the ground that its TNR policy, which exempted ear-tipped domestic cats from rabies booster requirements, violated state law. The Court disagreed and dismissed the suit.

Inks v Gaydos-Behanna Kennel | Filed: 2018 | Ruling: TBD
State: Pennsylvania
Allegheny County, PA, resident Jennifer Inks sued the Gaydos-Behanna Kennel, which is the contracted animal control provider for Liberty Burough, PA, alleging negligence following multiple attacks by a rabid feral domestic cat. The case is ongoing.

Winrock Villas Condominium Association v City of Albuquerque | Filed: 2018 | Ruling:
State: New Mexico
The Winrock Villas Condominium Association sued the City of Albuquerque, NM, alleging that its TNR policy was a public nuisance. The case was dropped following turnover within the Association leadership.

Britton v Keller | Filed: 2019 | Ruling: 2020; currently under appeal (as of June 2020)
State: New Mexico
Albuquerque, NM, resident Marcy Britton sued the City of Albuquerque in federal court, alleging that the City's TNR program is a violation of the Takings Clause of the fifth amendment and state law (nuisance and trespass). The federal claim was dismissed, and the court elected not to exercise supplemental jurisdiction over remaining state claims.

Bischoff v Crazy Crab | Filed: 2019 | Ruling: TBD
State: South Carolina
Beaufort County, SC, residents Stephen and Barbara Bischoff sued The Crazy Crab for damages due to injuries inflicted by a feral domestic cat living at The Crazy Crab restaurant. The Plaintiffs assert that the defendants "failed to properly warn its customers or take appropriate action to address the dangerous condition." The case is ongoing.

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HUMAN DIMENSIONS

The presence of free-ranging domestic cats on wildlife conservation lands is often directly or indirectly connected to human behaviors. For example, free-ranging domestic cat presence may be caused or contributed to by human abandonment of domestic cats, intentional or accidental feeding or sheltering, or permitting owned domestic cats to roam freely. Consequently, considering the various perspectives, values, and beliefs of diverse stakeholders, including those individuals whose behavior may contribute to domestic cat presence and those who may have an interest in management outcomes, is essential to achieving lasting management success.

Human attitudes toward domestic cats are context-specific, and these contexts can influence public perceptions of various risks and support of management actions. Whereas free-ranging domestic cats may be characterized as invasive in a wildlife conservation context, some members of the public or animal welfare organizations may instead view these animals as homeless pets (Leong et al. 2020), and these different perspectives can influence preferred management strategies (Farnworth et al. 2011, Lohr and Lepczyk 2014). Public opinions about domestic cats and their management are often split, complex, and internally contradictory, as has been observed in Florida (Wald and Jacobson 2013, 2014), Georgia (Loyd and Hernandez 2012), Illinois (Loyd and Miller 2010), Ohio (Lord 2008), Ontario (Van Patter et al. 2019), and Texas (Ash and Adams 2003, Dombrosky and Wolverton 2014). For managers, acknowledging and listening to people's concerns and understanding diverse perspectives may help to avoid conflicts, build productive relationships, and realize long-term management success.

Different types of free-ranging domestic cats may also necessitate different types of management interventions. For example, owned and unowned domestic cats are likely to have different stakeholders and different total impacts on wildlife resources (Loss et al. 2013, Cove et al. 2018). Because management actions could lead to stakeholder conflict, especially when lethal management techniques are employed, it is most beneficial when managers communicate with stakeholders early in the management planning process and prioritize management actions in areas of greatest harm to natural resources by free-ranging domestic cats. This stakeholder engagement may minimize conflict.

It is important to also consider the root causes of domestic cats roaming agency lands. Understanding how local communities think about domestic cats can be instructive for effective communications. For example, growing research around the world has investigated motivations for domestic cat owners to let their pets roam outdoors and perceptions of possible interventions. Domestic cat owners in the United Kingdom have expressed little concern over harm to wildlife caused by their domestic cats, and researchers have recommended considering the multiple factors and competing priorities that inform domestic cat owner decision-making, such as cat health and welfare, the ease of behavior change, and the cost of owner interventions (McDonald et al. 2015, Crowley et al. 2019). In such cases, an emphasis on disease transmission risks, both to and from domestic cats, may be more effective (Lepczyk et al. 2015, Gramza et al. 2016). In New Zealand, domestic cat owners were more likely to agree to keep their pets indoors at night than to do so at all times, and this behavioral change was linked to greater willingness to consider keeping their cats permanently indoors in the future (Linklater et al. 2019). Other studies in New Zealand point to owners being more likely to restrict their cats' outdoor activity if they receive these messages from trusted sources, such as veterinarians (MacDonald et al. 2015, McLeod et al. 2017). Interventions that include a public pledge may also be beneficial (MacDonald 2015). These findings may help managers interact with local communities to find solutions that will help minimize domestic cat incursions on agency lands.

Recommendations

Solutions that lessen the effects of free-ranging domestic cats on wildlife often involve human behavior change, conflict resolution, and effective communication. While it is imperative that managers control free-ranging domestic cats on agency lands, human dimensions and communications experts can help wildlife conservation practitioners understand these human dimensions and work toward developing innovative, collaborative solutions that protect wildlife populations and support domestic cat welfare. Many state and federal wildlife management agencies now employ human dimensions professionals, who should be consulted at the beginning of any domestic cat management effort. Below, we provide some guidelines for advancing dialogue on free-ranging domestic cat management and developing strategies to change human behavior.

1) Determine which human behaviors are leading to free-ranging domestic cats in the area of interest (McKenzie-Mohr et al. 2012, Linklater et al. 2019). To avoid wasting resources, prioritize targeted, specific behaviors rather than groups of behaviors that reduce negative impacts on wildlife. It is also important to target effective behaviors that are most likely to be adopted.

WHAT'S IN A NAME

Cat photo by ArthurHidden - www.freepik.com

Domestic cats may be described with a variety of names, such as those related to their socialization and lifestyle, and different names have been associated with varying acceptability of management actions (Farnworth et al. 2011). Understanding of these names can help avoid potential conflicts and confusion. While domestic cat terminology is not standardized, the following definitions will help familiarize managers with terms and concepts:

Indoor cat – a domestic cat that lives entirely indoors or goes outdoors under the supervision of a person; habituated to people

Indoor/Outdoor cat – a domestic cat that spends part of its time indoors and part of its time outdoors; habituated to people; while outdoors, roams without restriction

Barn cat – a domestic cat that is maintained on an individual's property, typically around a barn, for the purpose of pest control; may or may not be habituated to people; roams outdoors without restriction

Colony/Community cat – a domestic cat that congregates around a human-provided food source or shelter; may or may not be habituated to people; roams outdoors without restriction; frequently associated with trap, neuter, release or similar programs

Stray cat – a domestic cat that lives exclusively outdoors; habituated to people; roams outdoors without restriction

Feral cat – a domestic cat living in a wild state; unhabituated to people; roams outdoors without restriction; may live far away from human settlements

In a legal sense, an **at-large cat** is a domestic cat that is on the premises of a person other than an owner of the cat, without the consent of an occupant or owner of such premises, or on a public street, on public or private school grounds, or in any other public place, except when under the direct control of an owner.

Relatively simple and low-cost behaviors should be prioritized over more complex and costly behaviors.

2) Refrain from making assumptions about what stakeholder groups think about domestic cats. Instead, work to understand the various thought patterns (attitudes, beliefs, values, etc.) of stakeholders and how these thought patterns may drive decisions related to free-ranging domestic cats. Explore what values are shared among the stakeholder groups involved, and begin building relationships to learn more about each other. To do this, practitioners can partner with human dimensions specialists and explore the peer-reviewed literature related to the human dimensions of domestic cat issues.

3) Focus effort on areas of consensus. A wide variety of groups support management strategies that focus on reducing domestic cat abandonment and increasing adoption. These strategies can reduce the number of free-ranging domestic cats on the landscape. Commonly held values among the conservation and animal welfare communities include benevolence and humaneness. Members of both communities want animals to be treated humanely and care deeply about animals, although groups may use different definitions or focus on different aspects of what makes something humane. Striking a balance between animal welfare and protection of wildlife can bridge differences among stakeholder groups. In this context, promoting restriction behaviors for owned domestic cats can also be widely supported. Example strategies include the use of outdoor domestic cat enclosures and leashing.

Photo: Kirsten Leong

4) Construct messages that appeal to shared values. Providing facts and data alone rarely changes human minds or behavior; people seldom make decisions based on scientific evidence or rational deliberation, especially for conflicts based on different sets of values. On the contrary, hearing facts that refute their worldview can solidify people's already strongly held beliefs (Wald and Jacobson 2014). Crafting an approach that acknowledges strongly held values will improve the chances of a successful outcome. The effectiveness of various communication techniques is evaluated and discussed in a recent and very useful study (McLeod et al. 2017).

5) Form productive partnerships. Due to the complexity and sensitivity of these issues and the number of stakeholders involved (wildlife agencies, the public, local governments, etc.), meaningful progress may not be possible without establishing working relationships with both traditional and non-traditional partners. In these partnerships, it is extremely important to start small and begin to build trust through one-on-one conversations to learn more about the people and the groups they represent. See the **Partnerships** section for examples of successful partnerships, as well as challenges involved in collaborating.

Photo: Christine Kelly

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EDUCATION AND OUTREACH

Educating the public to engage them as partners remains a primary strategy for addressing myriad conservation issues, including the management of invasive species. Part of the vision of the Association's 2010 Conservation Education Strategy is "an informed and involved citizenry…[that] understands and actively participates in the stewardship and support of our natural resources."

Many fish and wildlife agencies maintain education branches or staff who provide conservation education training and programs to educators, children, and families. While the link between education and stewardship can be difficult to evaluate, according to the Association's Stewardship Education Best Practices Planning Guide, "researchers have come to three important conclusions about environmental and conservation education:

1. Ecological awareness and knowledge are not enough to cause long-lasting behavior changes, but they can provide a basis or readiness for learning and participation.
2. Ownership (a personal connection with one or more natural areas and knowledge of and/or investment in problems/issues) is critical to responsible environmental behaviors.
3. Instruction and experiences intended to foster ownership and empowerment (a sense of being able to make changes and resolve important problems and use critical issues investigation skills to do so) often permit individuals and groups to change their behavior."

The tools listed below can be used to help agencies educate the public about the impacts of free-ranging domestic cats. It is best to select from these tools with the specific audience and educational setting in mind. For example, the Association's Flying WILD program offers training for educators in activities they can use to incorporate bird and bird conservation in their instruction. This program can help students learn about the threat that outdoor domestic cats pose to birds before they become domestic cat owners. On the other hand, American Bird Conservancy's Cats Indoors program provides useful information for domestic cat owners about simple solutions to keep pets and wildlife safe. See the **Human Dimensions** section for related information, including effective messaging and strategies.

By incorporating these resources into educational programs and offerings, agencies may better engage the public as partners in addressing the issue of free-ranging domestic cats and their impacts on natural resources.

Photo: Association of Fish and Wildlife Agencies

Flying WILD: An Educator's Guide to Celebrating Birds | Association of Fish and Wildlife Agencies

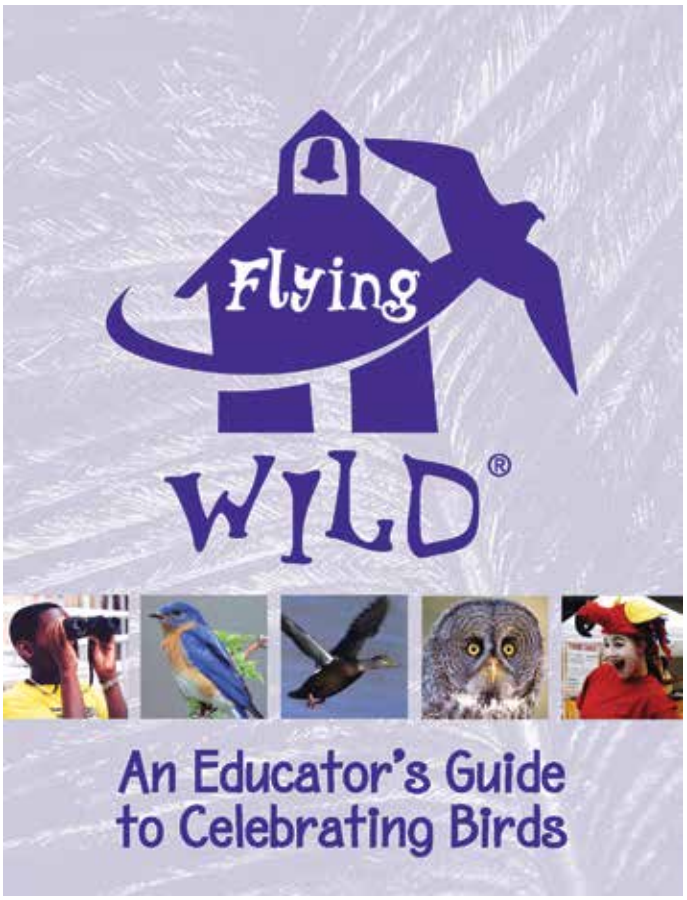
Flying WILD uses standards-based classroom activities and environmental stewardship projects to introduce students to bird conservation. Flying WILD encourages schools to work closely with conservation organizations, community groups, and businesses involved with birds to implement bird conservation projects and school bird festivals. Some state fish and wildlife agencies offer training for educators in Flying WILD materials. The curriculum guide is also available for purchase on the Association's website (see below). The following activities include mention of free-ranging domestic cat issues: Bird Action, Bird Buffet, Bird Friend or Foe?, Bird Hurdles, Feeder Frenzy, The Great Migration Challenge, Hidden Hazards, Jeop-Bird, and Migratory Mapping. For example, in the activity "The Great Migration Challenge," students move through migration stations that highlight the challenges faced by migrating birds. One station involves being caught and eaten by a free-ranging domestic cat. Other activities like "Bird Action" and "Bird Friend or Foe?" encourage students to take simple actions to protect birds, including keeping domestic cats indoors. www.flyingwild.org

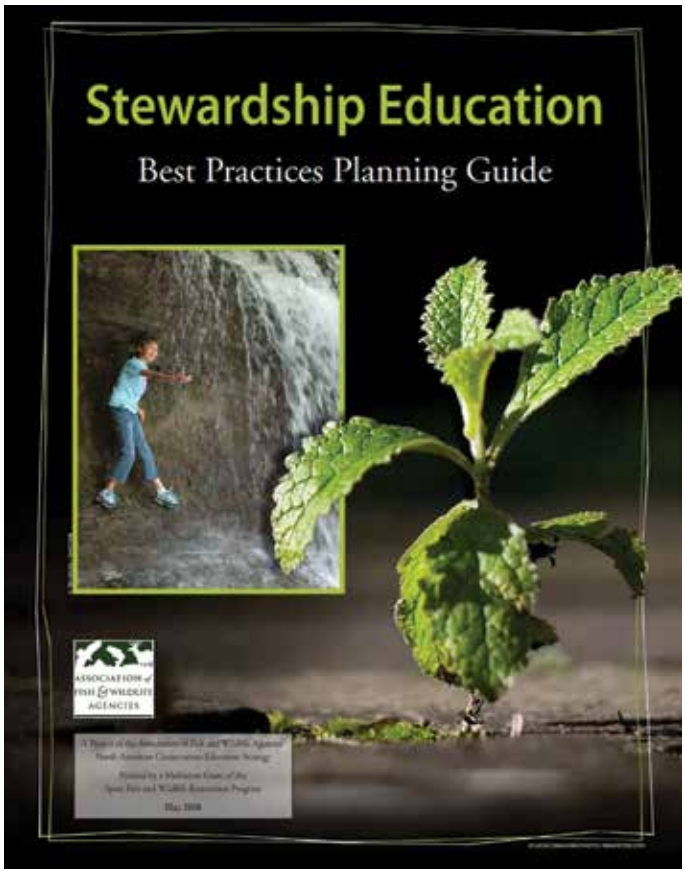
Cats Indoors | American Bird Conservancy

American Bird Conservancy's Cats Indoors program is dedicated to educating the public and policy makers about the many benefits to domestic cats, wildlife, and people when domestic cats are kept indoors or under an owner's direct control. The program promotes simple solutions that advocate treating domestic cats responsibly, more like people treat domestic dogs. Resources available include brochures, fact sheets, videos, a regular newsletter, and scientific literature. Domestic cat owners can also take a pledge online to keep their current or future pets safely contained.
www.abcbirds.org/cats

Cats and Birds: Keep Cats Safe and Save Bird Lives | Nature Canada

Keep Cats Safe and Save Bird Lives is a coalition of organizations led by Nature Canada that advocates for improving the treatment of domestic cats as a means of limiting impacts to the environment, particularly birds. Nature Canada works with national, regional, and local partners across Canada to cultivate municipal action and raise awareness.
https://catsandbirds.ca





Stewardship Education Best Practices Planning Guide | Association of Fish and Wildlife Agencies

Although this resource does not specifically pertain to free-ranging domestic cats, it provides recommendations, based on research and evaluation, for strengthening and developing natural resources stewardship components of fish and wildlife agency conservation education programs. By following the best practices described in this document, education programs will more effectively reach learners.
www.fishwildlife.org/application/files/5215/1373/1274/ConEd-Stewardship-Education-Best-Practices-Guide.pdf

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PARTNERSHIPS

Establishing partnerships with stakeholder organizations can be a powerful tool in achieving wildlife conservation aims. Building relationships with partners before acute management needs or conflicts can help to prevent or minimize potential misunderstandings and foster mutual trust and is especially important in invasive species management (Keitt et al. 2019). Over the years, numerous coalitions have been formed seeking to tackle free-ranging domestic cat issues with varying success (Table 1). Below, we highlight two of the successful partnerships so they may serve as examples for future efforts.

San Nicolas Island – California

Free-ranging domestic cat management was identified as an important step to restore seabird populations and ecosystem function on San Nicolas Island, one of the Channel Islands off the coast of California (Hanson et al. 2010). A coalition of stakeholders, including the U.S. Navy, U.S. Fish and Wildlife Service, Island Conservation, Institute for Wildlife Studies, and the Humane Society of the United States (HSUS), all participated in the domestic cat removal process. Between June 25, 2009, and February 17, 2010, 52 captured domestic cats were transported to a long-term "holding sanctuary" by HSUS, and the final two domestic cats were removed in June 2010 (Hanson et al. 2010, 2015). The late inclusion of HSUS in this project "allowed free-ranging domestic cats to be removed alive" and "benefitted the project by garnering widespread support" (Hanson et al. 2015).

Brevard Zoo – Florida

The Brevard Zoo in Melbourne, Florida, created an exhibit in 2018 designed to educate visitors about the impacts of free-ranging domestic cats on wildlife and to exemplify responsible cat ownership solutions. In partnership with the Brevard Humane Society, the zoo constructed and housed two adoptable domestic cats in a "catio" (enclosed patio for cats). According to Brevard Humane Society Executive Director Theresa Clifton, Brevard Zoo's catio protects wildlife and offers domestic cats a safe environment, calling the program "an ideal partnership" (Brevard Humane Society 2018).

Photo: Michelle Smurl

Partnerships for domestic cat management and control may include the interests of animal welfare, wildlife conservation, and human health organizations, and such interdisciplinary partnerships have served to express unified support for agency actions (American Bird Conservancy 2014). Non-profit organizations that have participated in alliances and/or publicly expressed their support for activities that would benefit the conservation of natural resources or protection of human safety on agency lands, such as those listed below, may serve as a starting point for future partnerships with agencies.

- American Association of Wildlife Veterinarians
- American Bird Conservancy
- Association of Avian Veterinarians
- Association of Zoos and Aquariums
- International Wildlife Rehabilitation Council
- National Association of State Public Health Veterinarians
- National Wildlife Federation
- National Wildlife Rehabilitators Association
- People for the Ethical Treatment of Animals
- Society for Conservation Biology
- The Wildlife Society

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Table 1

A selection of wildlife conservation partnership efforts initiated to address free-ranging domestic cat issues across the United States

State	Name	Stakeholder Organizations	Summary
California	N/A	Humane Society of the United States, Institute for Wildlife Studies, Island Conservation, U.S. Fish and Wildlife Service, U.S. Navy	Partner organizations successfully removed free-ranging domestic cats from San Nicolas Island. Most domestic cats were provided a lifelong home in a sanctuary off-island.
Florida	N/A	Brevard Humane Society, Brevard Zoo	These partner organizations joined forces in 2018 to educate the public about the impacts of free-ranging domestic cats on wildlife, model a solution for owned domestic cats, and facilitate adoptions.
Hawaiʻi	Cats and Wildlife Coalition	American Bird Conservancy, county humane societies, Hawaiʻi Cat Foundation, Hawaiʻi Department of Land and Natural Resources (DLNR), Humane Society of the United States, National Oceanic and Atmospheric Administration, National Park Service, The Wildlife Society – Hawaiʻi Chapter, U.S. Fish and Wildlife Service	Partner organizations sought to "develop and implement collaborative efforts among wildlife managers and animal welfare advocates to protect cats and wildlife." Though disagreement about how to control domestic cats near protected species limited the group's progress, the formation of the coalition facilitated the establishment of ongoing working relationships. Staff within the various groups of the coalition regularly communicate and work together on policy. For example, DLNR regularly interfaces with the Hawaiian Humane Society to support legislation that reduces animal abandonment and requires better pet identification.
Hawaiʻi	Kauaʻi Feral Cat Task Force	American Bird Conservancy, Best Friends Animal Society, County of Kauaʻi, Hawaiʻi DLNR, Hanalei Watershed Hui, Hawaiian Humane Society, Hui Hoʻomalu i ka ʻAina, Humane Society of the United States, Kauaʻi Albatross Network, Kauaʻi Ferals, Kauaʻi Humane Society, Kauaʻi Invasive Species Committee, National Park Service, Paradise Animal Clinic, University of Hawaiʻi, U.S. Fish and Wildlife Service	Convened by the County of Kauaʻi, this task force made recommendations in 2014 for the purpose of Kauaʻi becoming "free of feral, abandoned, and stray" domestic cats (Adler 2014).
Hawaiʻi	Toxoplasmosis and At-large Cat Technical Working Group (TACTwg)	City and County of Honolulu, County of Maui, Hawaiʻi DLNR, Office of Hawaiian Affairs, National Oceanic and Atmospheric Administration-Fisheries, National Park Service, U.S. Fish and Wildlife Service, U.S. Army Garrison Hawaiʻi, U.S. Department of Agriculture Animal and Plant Health Inspection Service, U.S. Geological Survey, U.S. Marine Corps Base Hawaiʻi, U.S. Naval Facilities Hawaiʻi Engineering Command	The TACTwg was formed in 2016 following a cluster of endangered Hawaiian monk seal (Neomonachus schauinslandi) deaths that were later determined to be caused by toxoplasmosis. Because domestic cats are the only definitive host of *Toxoplasma gondii* in Hawaiʻi, the group's mission includes addressing impacts and management of domestic cats. The TACTwg shares information and ideas, collects and conducts research, provides policy implementation advice, and educates the public about toxoplasmosis and at-large domestic cats risks. Membership in the TACTwg is currently limited to federal, state, and county government agency representatives.
Virginia	Comprehensive Animal Care Laws Working Group	Danville Area Humane Society, Virginia Alliance for Animal Shelters, Virginia Animal Control Association, Virginia Department of Agriculture and Consumer Services, Virginia Department Wildlife Resources, Virginia Department of Health, Virginia Veterinary Medical Association, Virginia Federation of Humane Societies	Established by the Virginia Department of Agriculture and Consumer Services to consider companion animal policies, the working group initially agreed that every domestic cat should be responsibly owned and managed in a way that promotes animal welfare, public health, and environmental stewardship. Productive conversations were derailed, however, over the management of free-ranging domestic cats.

CASE STUDY

Photo: Grant Sizemore

The Lānaʻi Cat Sanctuary (LCS) is a 3.5-acre fenced facility on the island of Lānaʻi that operates in partnership with a private company, residents, and volunteers to provide a management solution for free-ranging domestic cats. The facility, which houses over 600 domestic cats, has permanent staff and volunteers and has become a tourist attraction, which provides an additional source of revenue. Free-ranging domestic cats are captured and turned in to LCS by Lānaʻi residents, the state wildlife agency, and the conservation arm of Pūlama Lānaʻi, a private company that manages most of the land and hotels on Lānaʻi. More information on LCS, as well as information on what it takes to start a domestic cat sanctuary, can be found at www.lanaicatsanctuary.org/about-us.

Photo: Grant Sizemore

INTEGRATED MANAGEMENT SOLUTIONS

Management of free-ranging domestic cats is a critical component to maintaining the ecological integrity of wildlife conservation lands. Management programs on these lands should strive for zero free-ranging domestic cats to minimize conflicts with people and native wildlife. Numerous examples of successful management programs exist from sites across the globe, especially on islands, and such programs have achieved positive results for wildlife conservation (Nogales et al. 2004, Ratcliffe et al. 2009).

It would be beneficial for all conservation land managers to develop a management protocol to prevent, monitor, and manage free-ranging domestic cat incursions on lands they manage. The following decision tree may be used as a guide to help managers consider the process, management alternatives, and best practices for achieving a goal of zero free-ranging domestic cats on wildlife conservation lands in a variety of circumstances (Fig. 3).

Below, we briefly review existing strategies to manage free-ranging domestic cats, including but not limited to those provided in Figure 3 (page 28), to allow managers to make informed decisions in line with their specific needs and capabilities. We recommend that management protocols prioritize non-lethal control to the extent practicable and that all managers receive specialized training and demonstrate proficiency in the techniques they may employ. For specific guidance on management techniques, human safety, and other considerations, see Vantassel (2013), Sikes et al. (2016), and the **Domestic Cat Diseases** section of this document.

Prevention

Efforts to prevent the presence of domestic cats on conservation lands can help discourage long-term persistence and limit the likelihood of domestic cat establishment, making control efforts less burdensome. Prevention measures should be implemented in all cases.

Removal of Food, Water, and Shelter

Managers should take care to prohibit the purposeful or accidental provisioning of food, water, or shelter to domestic cats by staff or visitors. These resources, such as open trash receptacles, unsealed out-buildings, boxes and crates, and crawl spaces underneath buildings, not only encourage domestic cat immigration but also increase the likelihood of negative interactions between domestic cats, wildlife, and humans. Policies that prohibit the release, sheltering, and/or feeding of domestic cats on wildlife conservation lands should be enacted and enforced, and signs should be posted to notify the public of ongoing management. See the **Human Dimensions** and **Education and Outreach** sections of the document for communications guidance.

Public Engagement

Because domestic cat issues can often be influenced by human behavior (e.g., animal abandonment), public engagement will be an important component to preventing the presence of and managing domestic cats. See the **Human Dimensions**, **Education and Outreach**, and **Partnerships** sections of this document for further information on public engagement.

Inventory and Monitoring

To develop effective control efforts and reasonably confirm successful prevention or control of domestic cats on wildlife conservation lands, various techniques may be employed to determine presence of domestic cats and evaluate population size. Spotlight surveys, track surveys, hair snares, and camera traps have been used successfully (Edwards et al. 2000, Bengsen et al. 2011, Fisher et al. 2015). Traditional mark-recapture is less likely to be successful due to trap aversion (Fisher et al. 2015).

Control (options listed alphabetically)

Adoption | Non-lethal

Where partnerships with animal shelters, rescue centers, and animal welfare organizations can be established, live-capture of domestic cats and delivery for adoption is an excellent management strategy. Efforts should be made to ensure adopted domestic cats will not be able to return, either through free-ranging or abandonment, to wildlife conservation lands. See live-capture methods below to learn more about effective methods.

Enclosure | Non-lethal

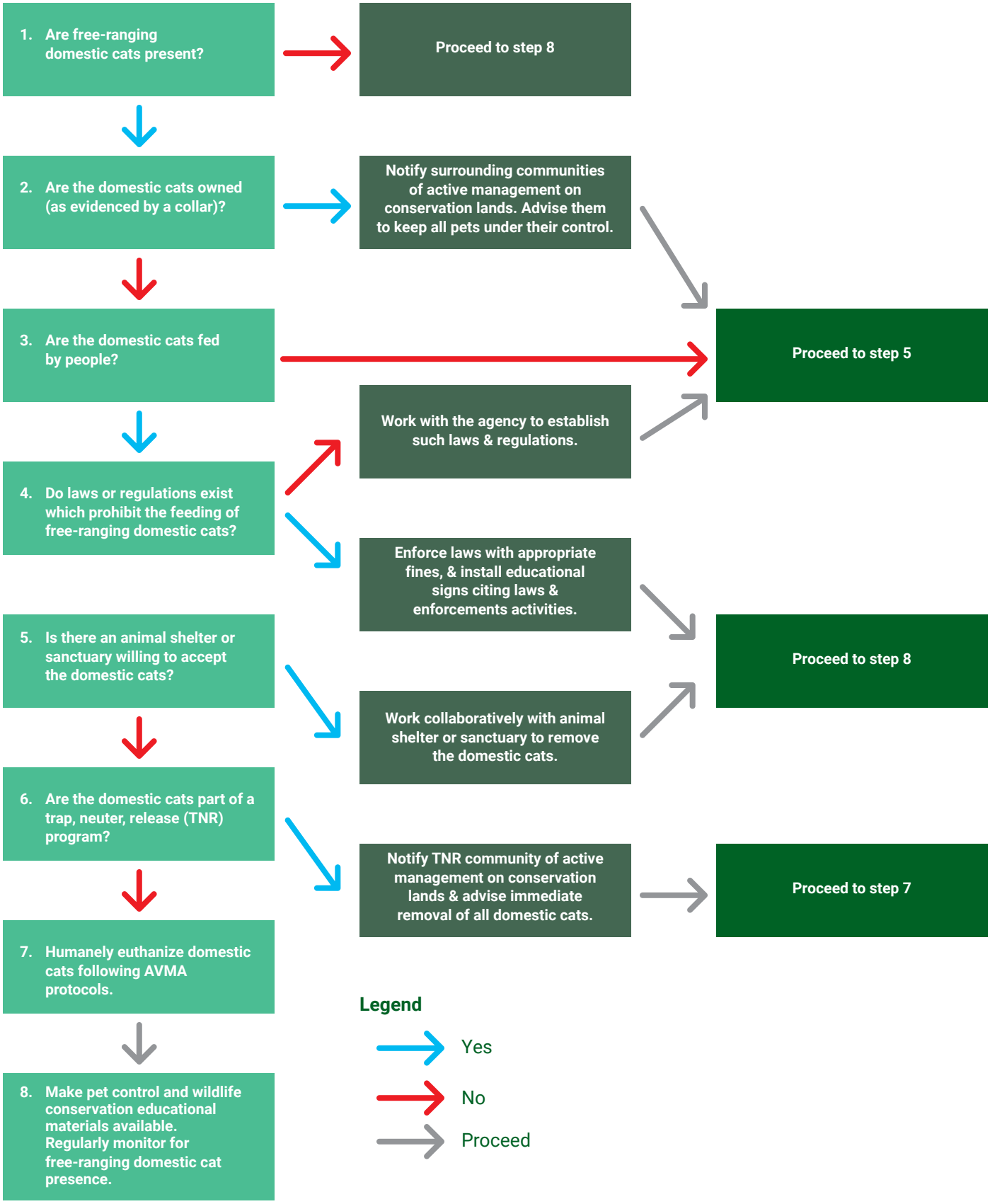
A domestic cat-proof enclosure may be constructed to temporarily or permanently house live-captured cats. Enclosures may be constructed on wildlife conservation lands, or domestic cats may be transported to existing off-site enclosures, such as domestic cat sanctuaries (e.g., Lānaʻi Cat Sanctuary). Proper care, including provision of food, water, and veterinary care, as well as waste disposal, and compliance with existing state and local laws is necessary, and managers should consider the long-term viability of enclosure options.

Euthanasia and Humane Killing | Lethal

Euthanasia or humane killing of free-ranging domestic cats should follow American Veterinary Medical Associa-

Figure 3

Domestic cat management decision tree.



tion (AVMA) guidelines (https://www.avma.org/sites/default/files/2020-01/2020-Euthanasia-Final-1-17-20.pdf) to ensure respectful and humane treatment before, during, and after death (Leary et al. 2019, Leary et al. 2020). Any employed method must also meet all applicable local laws and regulations. Lethal practices should be focused on free-ranging domestic cats that are sick or injured, exhibit behavioral abnormalities, or are aggressive. Use of lethal traps should not be used due to the danger to non-target species, especially listed or rare species. Euthanasia or humane killing should occur in a secluded or discrete area out of view of the general public or other personnel.

Exclosure | Non-lethal
A domestic cat-proof exclosure may be constructed to temporarily or permanently exclude free-ranging domestic cats from wildlife conservation lands. This strategy may be useful for relatively small areas but is generally cost-prohibitive for larger land areas and may inhibit movement of wildlife.

Live Capture | Non-lethal
Techniques for the live capture of free-ranging domestic cats include padded foot-hold traps and cage or box traps, among others (e.g., Fisher et al. 2015, Sikes et al. 2016). Capture methods should not cause injury or excessive stress and should limit exposure to weather and temperature extremes, limit time in the trap, and account for potential impacts to non-target species (Sikes et al. 2016).

Sterilization | Non-lethal
Sterilization of cats on wildlife conservation lands by itself does not sufficiently address ongoing issues of concern, such as predation of wildlife and/or the transmission of zoonotic diseases (Jessup 2004, Gerhold and Jessup 2013, Roebling et al. 2013). Although sterilization of owned cats is a recommended practice, strategies that maintain domestic cats roaming on wildlife conservation lands (e.g., trap, neuter, release [TNR]) are incompatible with wildlife management goals and should be prohibited (e.g., AAWV 1996, TPWD 2014, AVMA 2018, TWS 2020).

Toxicant | Lethal (not currently permitted in U.S.)
No toxicants are currently registered for domestic cat control use in the United States. In other countries (e.g., Australia and New Zealand), poisons such as sodium fluoroacetate (1080) and para-aminopropiophenone (PAPP) have been used to remove domestic cats (Moseby et al. 2009, Ratcliffe et al. 2009, Shapiro et al. 2010).

Photo: Grant Sizemore

In 2018, following an Endangered Species Act lawsuit settlement, New York State Office of Parks, Recreation, and Historic Preservation (State Parks) took action to manage free-ranging domestic cats maintained at Jones Beach State Park. Within five months of the settlement, State Parks staff had trapped and removed twenty-six domestic cats and placed them all in private sanctuaries. State Parks also removed all support structures (i.e., feeding stations, shelters) for domestic cats and, per the settlement agreement, will continue to monitor for and remove all free-ranging domestic cats from the park into the future. For more information, see the **Legal Issues** section of this document.

Photo: Grant Sizemore

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Photo: United States Fish and Wildlife Service

Photo: Greg Butcher

MODEL REGULATORY AND LEGAL LANGUAGE

Regulatory and legal language can be a powerful tool to prevent the establishment of free-ranging domestic cats and to guide management on agency lands. To date, however, these tools have not been prioritized, and uncertainty remains in many states regarding current authorities pertaining to free-ranging domestic cats (AFWA 2017). For those states desiring to clarify their authorities, referring to existing state and federal regulations and other states' laws may serve as a starting point for future action. Below, we provide examples of state and federal regulations and statutes that may be helpful in guiding management decisions and policy development.

State Regulations

Florida Water Management Districts:
State regulations prohibit domestic cats on Suwannee River Water Management District lands (FAC §40B-9.131) and in the Southwest Florida Water Management District (FAC §40D-9.190). Domestic cats must be leashed on St. Johns River Water Management District lands (FAC §40C-9.180).

Hawai'i Department of Land and Natural Resources:
State regulations prohibit animal abandonment and "feeding of colonies, strays, wildlife, or feral animals" on Hawai'i Division of Boating and Ocean Recreation property (HAR §13-232-57.1, HAR §13-232-57.2).

Idaho Department of Fish and Game:
Regulations prohibit domestic cats from running at large on lands controlled by the Department when a person is not present to control or care for it (IAC §13.01.03).

New Mexico Division of Energy, Minerals, and Natural Resources:
All domestic cats in areas of the New Mexico State Parks system shall be restrained from running at large, controlled by their owners, and vaccinated in accordance with local laws; owners must pick up after their pets; and domestic cats are prohibited from certain parks and all visitor centers (NMAC §19.5.2.28).

Pennsylvania Department of Conservation and Natural Resources:
State regulations require that "an owner, keeper, or handler of a pet" may only have a pet in a state park if the animal is on a leash or in a cage or crate, the animal does not cause damage to property or resources, the animal is properly vaccinated and licensed as required by law, and any droppings are disposed of in a trash receptacle (17 PA Code §11.212).

West Virginia Division of Natural Resources:
Regulations permit domestic cats in state park and state forest cabins and their immediate areas but prohibit them in lodges, swimming pools, and beach swimming areas (Natural Resources §58-31-2.12). These regulations also require that cats be "restrained at all times on a sturdy leash" in and around campgrounds, picnic areas, playgrounds, designated roads and trails and "other similar intense public use areas." Owners are responsible for removing droppings, preventing noise and disturbances to other guests, and for all damage caused.

Federal Regulations

Executive Orders

13112 | Invasive Species
This executive order directs agencies to prevent the introduction of invasive species and control invasive species once they have been introduced. This order was amended by EO 13751.

13751 | Safeguarding the Nation from the Impacts of Invasive Species
This executive order amends EO 13112 and directs actions to continue coordinated Federal prevention and control of invasive species. Specifically, this order affirmed that it is the policy of the United States "to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established."

Bureau of Land Management

The Bureau of Land Management's policy and guidance on the introduction of exotic species established that "exotic or domesticated species that have reverted to a feral state (feral species) that are adversely impacting native species and/or habitats should be controlled and/or removed" (BLM 1992).

Department of Defense

The Department of Defense published a technical guide for all military installations in the United States as an example of stray animal control policy and the proper implementation of such a policy (Wildie et al. 2012).

Department of the Navy

Department of the Navy policy "requires Navy commands to institute pro-active pet management procedures in order to prevent establishment of free roaming cat and dog populations" and emphasizes that "privately-owned or stray animals will not be permitted to run at large on military reservations" (U.S. Navy 2002).

National Park Service

The National Park Service (NPS) requires that all pets be in a crate, cage, restrained on a leash, or otherwise contained at all times. Pets running at large may be impounded, and pets or feral animals observed "in the act of killing, injuring, or molesting humans, livestock, or wildlife may be destroyed" (36 CFR §2.15). NPS policy also states that "all exotic plant and animal species that are not maintained to meet an identified park purpose will be managed – up to and including eradication" if the species meets several qualifications, such as harming wildlife or causing a public health hazard (NPS 2006).

U.S. Forest Service

The U.S. Forest Service Manual (FSM) 2900 chapter on Invasive Species Management sets forth National Forest System policy, responsibilities, and direction for the prevention, detection, control, and restoration of effects from aquatic and terrestrial invasive species including vertebrates, invertebrates, plants, and pathogens (2011).

State Laws

State laws regarding domestic cats frequently, though not always, fall under agricultural code. We encourage agencies to review their state laws and to work with relevant agencies and personnel to establish and/or strengthen laws that effectively reduce the likelihood of harmful interactions between domestic cats and wildlife, as well as conflicts with natural resources managers or recreationists. Relevant topics include abandonment, sterilization, identification, vaccination, and control (e.g., leash law) of domestic cats. American Bird Conservancy has created model companion animal legislative language that may serve as a template for preventing domestic cat conflicts (ABC 2017).

Photo: Michelle Smurl

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Photo: Christine Kelly

Photo: Sara Schweitzer

Appendix

DISEASES OF CATS

TYPE OF DISEASE	AGENT	TRANSMISSION	ZOONOTIC	CAT CLINICAL SIGNS	TREATMENT	PREVENTION
VIRUSES						
Rabies	Rabies lyssavirus (Rhabdoviridae)	Bite of a rabid animal; saliva	YES	salivation, seizures, dumb/ furious behavior, encephalitis	None	Vaccination
Feline leukemia/Feline immunodeficiency disease	FIV /FELV	"lateral" - cat saliva, blood, urine, feces; grooming, bite wounds, fighting; "vertical" - kittens in-utero/nursing -milk	NO	progressive multi-organ failure and debilitiation, blood dyscrasias	None	Vaccination
Pseudorabies	PRV (Herpesvirus suis)	Oral, ingestion infected tissues	NO	intense pruitis, encephalitis	None	
Feline Infectious Peritonitis	Feline beta-coronavirus	Fecal-oral	NO	wet /dry forms; multi-organ failure	Palliative care	Intranasal vaccine - not proven effective
SARS	SARS beta-coronavirus	Ingestion (oral) infected prey; experimental intra-tracheal	Cats not known to be exposure source to humans	acute pneumonia	None	Prevent contact
COVID19	SARS-Cov-2 beta-coronavirus	lateral transmission from infected humans and conspecifics; oral-nasal; inhalation; experimental intranasal	Cats not known to be exposure source to humans	sneezing, coughing, oculonasal discharge, rhinitis	None	Prevent contact
Feline Panleukopenia (Feline Distemper)	Feline panleukopenia / parvo virus	Urine, feces, nasal secretions; contaminated bedding, cages, food dishes	NO	Depression, loss of appetite, high fever, lethargy, vomiting, severe diarrhea, nasal discharge, and dehydration; congenital feline cerebellar ataxia	Supportive care	Vaccination
Avian/Swine Influenza	HPAI (H5N1, H1N1), other Type A influenza viruses	Ingestion (oral) infected prey	Cats not known to be exposure source to humans	fever, lethargy, respiratory distress, acute pneumonia, encephalitis	None	Prevent contact
BACTERIA						
Giardiasis	Giardia lamblia	Oral - contaminated water	YES	diarrhea +/- bloody	Antibiotics	Avoid contaminated water sources
Crytosporidiosis	Cryptosporidium sp.	Oral ingestion - contaminated water, food, feces	YES	fever, diarrhea, dehydration, lethargy	Supportive	Avoid contaminated water sources
Flea-borne spotted fever (cats)	Rickettsia typhi, R. felis	fleas	YES (cat-flea typhus in humans)	skin rash, fever	Flea products, antibiotics, supportive	flea control
Ehrlichiosis/ Anaplasmosis	Rickettsia: Ehrlichia chaffeensis and Ehrlichia ewingii; Anaplasma phagocytophilum	Ticks	YES (via tick - cats may be a reservoir host)	Acute and chronic stages; Anemia, lethargy, cough, enlarged lymph nodes/spleen, lameness	Topical insecticides, antibiotics, supportive care	Topical insecticides (Tick control)
Babesiosis (Piroplasmosis)	Babesia felis	Ticks, cat bites, transplacental	NO	Anemia, depression, dark-colored urine, fever, and enlarged lymph nodes, shock	Anti-malarial + antibiotic, blood transfusion	Avoid contaminated water sources
Cytauxzoonosis (Bobcat Fever)	Cytauxzoon felis	Ticks	NO	Severe anemia, fever, anorexia, dyspnea, and icterus, rapid death	Anti-malarial + antibiotic; blood transfusion	Tick control
Sylvatic plague (bubonic, pneumonic, septicemic)	Yersinia pestis	fleas	YES	swollen/abscessed peripheral lymph nodes, fever, pneumonia	Flea products, Antibiotics	flea control
Tularemia	Franciscella tularensis	fleas, ticks, ingestion, aerosol	YES	high fever, enlarged lymph nodes, pneumonia	Antibiotics	Avoid contaminated water sources
Borreliosis (Lyme disease)	Borrelia burgdorferi	Ticks	YES (via tick)	lameness, fever, swollen lymph nodes and joints; anorexia, chronic kidney, heart disease	Antibiotics	Avoid contaminated water sources
Bordetellosis	Bordetella bronchiseptica	Aerosol	YES	"fever, nasal discharge, sneezing, coughing, lethary, submandibular lymphadenopathy"	Antibiotics	Intranasal vaccination

DISEASES OF CATS

TYPE OF DISEASE	AGENT	TRANSMISSION	ZOONOTIC	CAT CLINICAL SIGNS	TREATMENT	PREVENTION
BACTERIA cont.						
Bartonellosis (cat scratch disease)	Bartonella henselae	Fleas	YES	subclinical bacteremia, occasional endocarditis	Antibiotics	Flea control
Haemobartonellosis (Feline Infectious Anemia)	Mycoplasma haemofelis	Fleas, ticks	NO	severe anemia, depression, weight loss, dyspnea, jaundice, acute death	Antibiotics; blood transfusion	Flea/tick control
Campylobacteriosis	Campylobacter jejuni	Oral ingestion - contaminated water, food, feces	YES	Diarrhea, carrier state	Antibiotics	Avoid raw/ undercooked food
Helicobacteriosis	Helicobacter felis; H. pylori	Oral ingestion - contaminated water, food, feces	YES	Gastritis	Antibiotics (limited)	Sanitation
Salmonellosis	Salmonella spp.	Infected foods (offal, live prey, uncooked meat), contaminated water; fecal/oral shed (carriers).	YES	Fever, vomiting, diarrhea, or asymptomatic carrier	Antibiotics	Sanitation
Pasteurellosis	Pasteurella multocida	normal oral flora, cat bites	YES	asymptomatic; bite or scratch wounds/ abscess	Antibiotics	Avoid contaminated water sources
Staphylococcosis	Methicillin-resistant Staph. aureus (MRSA)	reverse zoonosis from human contact	YES	asymptomatic carrier		Avoid cross-contamination
PARASITES						
Toxoplasmosis	Toxoplasma gondii	Ingestion (oral)	YES	generally asymptomatic -cat is definitive host (fecal shedding ooycysts)	None	
Baylesascariasis (roundworm)	Baylesascaris procyonis	Fecal-oral	YES	encephalitis, larval migrans		Parasiticides
Roundworm Infection (cats)/Ocular & visceral larval migrans (humans)	Toxocara cati	Fecal-oral	YES	may be asymptomatic or weight loss, diarrhea; fecal shed roundworm eggs		Parasiticides
Hookworm Infection (cats) /Cutaneous larval migrans (humans)	Uncinaria sp., Ancyclostoma sp.	Fecal-oral	YES	may be asymptomatic or diarhhea, weight loss, anemia; fecal shed hookworm eggs		Parasiticides
Tapeworm (cats)	Dipylidium caninum	Fleas	YES	Diarrhea, weight loss, proglottids in feces		Parasiticides
Trematode Alaria infection (alariosis)	Alaria spp (A. alata, A. mustelae, etc)	Fecal-oral	YES	carnivores -including cats - are definitive hosts; trematode ova shed in feces; cercarial stages develop in intermediate/ paratenic hosts consumed as prey species for carnivores. Human cases from game meat	Parasiticides - definitive host	Parasiticides
Scabies	Sarcoptes scabiei,	Lateral transmission, contaminated bedding	YES	pruritis, alopecia, papular skin lesions; secondary dermatitis	Mitacides	Decontaminate environment and bedding
FUNGAL						
Sporotrichosis	Sporothrix schenckii	skin abrasions, bites/scratches, inhalation		"draining puncture wounds similar to fight wound abscesses"	Antifungals	
Dermatophytosis (Ringworm)	Microsporum canis, Trichophyton sp.	Topical/ direct dermal contact, contaminated bedding, carrier state	YES	Patchy alopecia, pruitis, scaly dermatitis, nail-bed infections	Antifungal baths, topical or oral medications	Decontaminate environment, Improve husbandry

ASSOCIATION of FISH & WILDLIFE AGENCIES