FISH AND WILDLIFE HEALTH COMMITTEE
Chair: Paul Johansen (WV)
Vice-Chair: Colin Gillin (OR)
AFWA Committee Staff Support: Jonathan Mawdsley
Friday, September 11, 2020
1:00 – 4:00 PM
Teleconference

Agenda

- Welcome & Introductions
  Paul Johansen (WV)

- Meeting Minutes / New Business / Agenda additions or changes

- Fish and Wildlife Health Legislative Update
  Jen Mock Schaeffer/Devin DeMario (AFWA)

- Fish and Wildlife Health Initiative Update
  Paul Johansen (WV)

- FDA Drug Compounding Changes
  Anne Justice-Allen, Patty Klein, Colin Gillin

- Training & Qualifications for Wildlife Veterinarians & Health Professionals
  Mark Drew / Jonathan Sleeman ACZM Proposal

- Feral And Free-Ranging Cat Subcommittee Toolkit
  Sara Schweitzer (NC) / Colin Gillin (OR)

- Aquatic Fish and Wildlife Health Update
  - CA Hatchery

  Gary Whelan (Michigan)

- White-nose Syndrome in Bats Update
  Jeremy Coleman (USFWS)

- Lead and Fish and Wildlife Health Working Group Update
  Stafford Lehr (CA)

- Rabbit Hemorrhagic Disease Virus 2 Update
  Colin Gillin (OR) / Anne Justice Allen (AZ) / USDA rep

- SARs Cov-2 in Wildlife Update
  Bats – USGS Update
  AFWA Guidance

- MAFWA Resolutions (Non-lead partnership and One-Health)
  Paul Johansen (WV)

- WAFWA Wildlife Health Committee Update
  Mike Miller (CO) / Mary Wood (CO)

- Chronic Wasting Disease Updates and Discussion
  - MAFWA CWD Value Stream Mapping – *Kelly Myers*
  - Multistate Conservation Grant Update – *John Fischer*
  - BMP Guidance and Updates? – *Colin Gillin, Jonathan Mawdsley*
  - USDA – Captive Cervid Program Update & Cooperative Agreement Funding *Tracy Nichols (USDA)*
  - State Updates *Round-table discussion with committee members*

- Other Business / News / Funding / Opportunities

National Strategy to Reduce Risk of Chronic Wasting Disease Transmission from Carcass Transport

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A Report from the Association of Fish and Wildlife Agencies, Washington, D.C., USA

Background and Purpose of this Document

Chronic Wasting Disease (CWD) is a 100% fatal, transmissible neurodegenerative disease of deer, elk, moose, reindeer, and other species of the family Cervidae. Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden. In areas where CWD has become established, it has emerged as a major threat, reducing the health of cervid populations and causing or exacerbating long-term population declines in the affected species.

To assist state fish and wildlife agencies and partners in managing this disease, the Association of Fish and Wildlife Agencies developed the first-ever set of ***Best Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease*** in 2017-2018 (AFWA CWD BMPs, available online at https://www.fishwildlife.org/application/files/5215/3729/1805/AFWA_CWD_BMPS_12_September_2018_FINAL.pdf). These BMPs are supported by an 111-page technical document that provides additional information about each practice as well as citations to the relevant scientific and technical literature (see: https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf)

The AFWA CWD BMPs identify a set of activities which are known or likely to increase the risk of accelerating or exacerbating the spread of CWD within wild and/or captive cervid populations. In particular, transport of infected live animals and the transport of infected animal carcasses or parts are both known pathways by which CWD has been spread within and between cervid populations. Other activities that lead to large or unnatural concentrations of cervids, such as bating or feeding and the use of scent attractants or lures, can also pose an elevated risk of CWD transmission.

In September, 2018, the Directors of the Association of Fish and Wildlife Agencies endorsed the AFWA CWD BMPs and asked the Association's Fish and Wildlife Health Committee to develop four new national strategies that would help state fish and wildlife agencies take steps to reduce the risk of CWD transmission from 1) live animal transport, 2) carcass transport, 3) feeding and baiting, and 4) the use of urine-based scent attractants.

The committee's first step in considering these four topics was to identify mechanisms already in place within state governments that can be utilized or adopted by managers in order to implement strategic practices that will reduce the risk of CWD transmission. As discussed briefly in the AFWA CWD BMP Technical Report, the individual states have already implemented recommendations similar to or identical to those contained in the AFWA CWD BMPs using a variety of available mechanisms, ranging from legislation and regulation in certain states, to voluntary education and outreach measures that engage various user communities.

It is important to note that the available strategies and approaches for implementing particular best practices are generally contingent on the particular political and legislative context of an individual state. We recognize and explicitly state in the AFWA CWD BMP document and Technical Report that the AFWA Best Practices are most definitely not intended to serve as "one size fits all," and that different practices may be appropriate in different states. In many cases (including that of carcass transport), multiple practices were explicitly identified in the AFWA CWD BMP Technical Report, all of which will provide managers with some level of risk reduction, and some of which may be more appropriate or feasible to implement under particular management and regulatory contexts.

At the request of the AFWA Fish and Wildlife Health Committee, AFWA's staff attorney conducted an initial review of the existing state laws and regulations regarding carcass transport, live animal transport, feeding and baiting, and urine. From this review, it was readily apparent that the most extensive and consistent body of work undertaken to date by the states was in the area of regulation of carcass transport, with 42 states already having implemented some sort of carcass transport regulations. With this extensive body of existing work to draw from, the committee decided to focus its initial efforts on the development of a national strategy for reducing risk of CWD transmission from carcass transport, building on the solid foundation of laws and regulations already developed by state governments, with the goal of presenting a set of tools and approaches that would assist states in implementing the AFWA CWD BMPs related to carcass transport.

Elements of the Strategy

This strategy includes three key components:

1) A statement of the current best practices for reducing risk of CWD transmission from carcass transport, based on best-available current peer-reviewed science and derived directly from the most recent edition of the AFWA Best Management Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease and accompanying Technical Report, as published on the AFWA website**;**

2) An analysis of current state legislation and regulations regarding CWD carcass transport, with discussion of differences among states and opportunities to improve or enhance existing state regulations in light of the recommendations contained in the AFWA best practices**;**

3) Sample or model language for state regulations on carcass transport, for consideration and review by the individual states in order to help to improve alignment of existing regulations with the current best practices for reducing risk of CWD transmission from carcass transport.

Implementation of the strategic direction outlined in this document is entirely at the discretion of individual states. This document is not intended to replace or supplant any existing law, regulation, or other management directive of any individual state or group of states.

Background Information on Chronic Wasting Disease

What is CWD?

Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy that infects North American deer, elk, moose, and related species (Williams and Miller 2002). This type of pathogen has been documented in mammalian species, including cattle, sheep, humans, and members of the deer family (Cervidae or cervids). The consensus that has emerged from long-term research dedicated to understanding TSEs indicates that prions are the causative agents of all TSEs, including CWD. These prions are misfolded proteins that accumulate in the brainstem and lymphatic tissue of infected animals and results in neurodegeneration and death. Despite extensive development efforts, there are no vaccines or treatments, and no practical live animal or food safety tests for CWD (Gillin and Mawdsley 2018).

Why does CWD matter?

The continued spread of CWD is posing serious threats to wildlife populations and the funds available to manage and conserve wildlife. In states where CWD is established, it has emerged as a major threat, reducing the health of cervid populations and causing long-term population declines (Edmunds et al. 2016; De Vivo et al. 2017). Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden (Gillin and Mawdsley 2018). The introduction of CWD into novel free-ranging deer herds has threatened the sustainability of our wildlife resources and conservation programs and created concerns over the potential implications to human health.

Impacts of CWD:

Wildlife Resource and Hunting

- Chronic wasting disease slowly invades a population and reduces its resiliency. Herds heavily infected with CWD are unable to sustain the combination of disease mortality and hunter harvest (Williams and Miller 2002; Edmunds et al. 2016; De Vivo et al. 2017).
- In states where CWD is established, cervid herds have shown declines of up to 10% a year (Edmunds et al. 2016; De Vivo et al. 2017).
- Once it is widely established, all efforts to eradicate CWD from free-ranging herds have been unsuccessful (Williams and Miller 2002).
- CWD threatens a vibrant hunting community in the United States which provides essential protein resources to many local communities; it is estimated that the nation's 10.9 million white-tailed deer hunters annually harvest 350 million pounds of meat, equating to 1.4 billion meals (Bishop 2010; Southwick Associates 2012).

- CWD also threatens local economies; deer hunting alone contributes an estimated $40 billion to the U. S. economy (Southwick Associates 2012).

Conservation Programs

- In the short term, CWD is causing reallocation of precious financial and staff-time resources and can be widely disruptive to existing programs (Bishop 2010).
- In the longer term, diseases such as CWD pose a threat to the financial cornerstone of fisheries and wildlife programs because sales of deer hunting licenses represent more than 50% of annual revenue (Bishop 2010; Southwick Associates 2012).

Human Health

- There is no evidence to support transmission of CWD from wildlife to humans. However, bovine spongiform encephalopathy, a disease with similar pathogenesis as CWD has resulted in at least 224 people becoming infected with a deadly variant of Creutzfeldt-Jakob disease (Ghani et al. 2000).
- Declining hunting participation has already been documented in states such as Wisconsin because of perceived risk to human health (Bishop 2010).
- The Center for Disease Control and the World Health Organization has recommended against consuming meat from animals infected with CWD (see: https://www.cdc.gov/prions/cwd/index.html).

Literature Cited

Bishop R. C. 2010. The Economic Impacts of Chronic Wasting Disease (CWD) in Wisconsin, Human Dimensions of Wildlife, 9(3):181–192, DOI: 10.1080/10871200490479963

DeVivo M. T., D. R. Edmunds, M. J. Kauffman, B. A. Schumaker, J. Binfet, T. J. Kreeger, B. J Richards, H. M Schatzl, and T. E. Cornish. 2017. Endemic chronic wasting disease causes mule deer population decline in Wyoming. PLoS ONE 12(10): e0186512. https://doi.org/10.1371/journal.pone.0186512

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Ghani, A. C., N. M. Ferguson, C. A. Donnelly, and R. M. Anderson. 2000. Predicted vCJD mortality in Great Britain. Nature 406:583-584.

Gillin, C. M., and J. R. Mawdsley (eds.). 2018. AFWA Technical Report on Best Management Practices for Surveillance, Management and Control of Chronic Wasting Disease. Association of Fish and Wildlife Agencies, Washington, D. C. 111 pp.

Southwick Associates. 2012. “Hunting in America: An Economic Force for Conservation.” https://www.fs.fed.us/biology/resources/pubs/wildlife/HuntingEconomicImpacts-NSSF-Southwick.pdf.

Williams, E. S. and M. W. Miller. 2002. Chronic wasting disease in deer and elk in North America. Scientific and Technical Review of the Office International des Epizooties (Paris) 21(2):305–316.

A Review of Best Management Practices to Reduce or Minimize the Risk of Chronic Wasting Disease Transmission from Carcass Transport

The following information is reprinted verbatim from the Technical Report on the AFWA CWD BMPs, which is available for download at https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf

Movement of Hunter-Harvested Cervid Carcasses and Tissues

Best Management Practice for reducing the risk of CWD transmission and establishment of CWD via movement of hunter-harvested cervid carcasses and tissues:

- **Prohibit the importation of intact cervid carcasses (e.g. carcasses with spinal column and brain tissue) from all states and provinces.** This restriction would allow cut/wrapped meat, deboned meat, cleaned skulls or skull cap with no brain material, shed antlers, hides, canine teeth, and finished taxidermy mounts to be imported from a hunter-harvested cervid. Restricting the interstate/province movement of all potentially infective neural tissue from CWD infected states and provinces, and states and provinces with unknown or no known detection of CWD, will greatly reduce the risk of moving CWD between states and provinces. An interstate/province import ban on high risk carcass parts originating from captive or shooter facilities from all states and provinces regardless of CWD status would reduce risk of importing CWD contaminated tissues into a state/province. Agencies would need to provide a program for hunters to report that their meat is from a CWD positive animal and provide directions or a means for destroying the meat or other materials from that animal.

The following list describes several additional and alternative scientifically grounded management practices for reducing or eliminating risk of disease transmission. Implementation of any of these practices will depend on a range of factors in each state, including acceptability of the proposed practice to hunters, decision-makers and the general public.

- **Allow importation of quartered carcasses with no central nervous system tissue (spinal column or brain tissue), in addition to the permitted items above.** This restriction would provide additional flexibility for hunters but would increase risk of importation of CWD from carcass part disposal issues associated with waste bone from quartered animal parts.
- **Prohibit the intrastate/intraprovincial movement of intact cervid carcasses from CWD- infected areas.** This restriction would allow only cut/wrapped meat, deboned meat, cleaned skulls or skull cap, shed antlers, hides, canine teeth, and finished taxidermy mounts to be moved outside known CWD-infected areas. Restricting the intrastate/intraprovincial movement of potentially infective neural tissue from a CWD area to a new CWD-free

environment, will limit short and cumulatively more significant movements of the prion across the landscape. Agencies would need to provide a program for hunters to report when their meat is from a CWD positive animal and provide directions for destroying the meat or other materials from that animal.

- **Implement an import ban on all parts, including meat and antlers, from CWD-positive states/provinces/territories**. This alternative will restrict movement of all carcass parts and reduce the risk of moving prions from known CWD positive areas to uninfected environments. An interstate/province/territory import ban on carcasses including high risk carcass parts originating from captive or shooter facilities from CWD positive states and provinces would reduce risk of importing CWD contaminated tissues into a state/province/territory.
- **Prohibit importation of intact cervid carcasses from the states and provinces where CWD has been detected in captive or free-ranging cervid populations.** This restriction would allow cut/wrapped meat, deboned meat, cleaned skulls or skull cap, shed antlers, hides, canine teeth, and finished taxidermy mounts to be imported from a hunter-harvested cervid from a CWD positive state. However, with this practice, challenges exist for agencies because of the dynamic nature of CWD discoveries (both wild and domestic) involving the potential undetected movement of CWD to new areas and the non-uniform sampling effort by which states and provinces conduct surveillance. Many states currently employ this practice however, it does present more risk than a more comprehensive prohibition, leaving states with decisions on how much risk they are willing to accept. Agencies would need to provide a program for hunters to report that their meat is from a CWD positive animal and provide directions or a means for destroying the meat or other materials from that animal.
- **States, provinces, and territories without documented cases of CWD could implement a blanket import ban on harvested cervids inclusive of meat and antlers, from all areas, regardless of CWD status.** This alternative would provide the greatest reduction in the risk of importation of CWD. However, its implementation has the greatest economic and political impacts to states/provinces impact to states/provinces, along with reduced hunter opportunity by restricting or eliminating non-resident hunting. While this is an option, it would likely is considered be viewed as the least acceptable alternative, given the consequences. A blanket import ban would simplify import regulation of carcasses for agencies and enforcement purposes. However, the regulation will be unpopular with the state's hunting public who enjoy hunting in other states and particularly those hunters who hunt as nonresidents in non- CWD areas. In addition, such restrictions would significantly impact states, provinces, and territories economically, due to direct economic losses from a decrease in non-resident license sales and indirect expenditures (e.g., hotels, fuel, and groceries). An interstate/interprovincial carcass import ban on carcasses originating from

captive or shooter facilities would also reduce risk for importing CWD contaminated tissues from these sources.

In addition, states and provinces should consider adopting the following regulations and policies:

- Provide educational material (online videos) for hunters on how to field-dress and debone carcasses and prepare skull caps or taxidermy mounts to ensure they are in compliance with CWD regulations.
- Require all meat be processed in the state where the animal was harvested, especially when hunting in CWD-enzootic states. Regulations may be required to ensure that local butchers do not process animals from out-of-state.
- Ensure consistent enforcement of regulations with carcass seizures and penalties for violations.
- Provide information about CWD-positive counties, state, provinces, and countries on wildlife agency websites that are updated regularly.
- Provide web resources showing how and where a hunter can have their animal tested.
- Provide a web resource that has a better user interface to display such as, Cervid carcass regulations by state - Michigan DNR where hunters can search by their destination state/province and their residence state /province to ensure they are in compliance.
    - All states, provinces, and territories should provide a notification protocol for CWD-positive animals harvested by a non-resident hunter. This would include direct notification to the state/provincial agency of a nonresident hunter and the hunter. This procedure allows for contact between the home state/provincial agency and the hunter to determine 1) if the carcass was legally imported and 2) if the carcass, parts, or game meat can be recovered for proper disposal by incineration or digestion.
- States and provinces positive for CWD should notify all non-resident hunters at time of license purchase or thereafter, that they likely are prohibited from importing carcass parts or entire carcasses to their home states and provinces. In some jurisdictions this may not be feasible.

Additional Considerations

- States and provinces that may restrict importation of carcasses or parts should consider allowing through passage of appropriately cut/wrapped meat, quarters with no part of the brain or spinal column attached, deboned meat, cleaned skulls or skull cap from CWD positive states/provinces.

- State /province/territory could consider allowing importation of whole cervid carcasses, provided the carcass is accompanied by a 'not detected' CWD test. This may be difficult to implement, due to the turn-around time required for CWD testing.
- Current regulations by state, Cervid carcass regulations by state - Michigan DNR

Supporting Strategies and Evidence

States, provinces, and territories should develop carcass transportation recommendations and regulations that are uniform and consistent in order to, 1) stop movement of prions across the landscape, 2) simplify carcass importation laws to reduce confusion to hunters, and 3) minimize inconsistencies with regulations from other states and provinces. CWD has been found at varied, albeit reduced levels in meat and other tissues (Angers et al. 2006, Kramm et al. 2017).

Movement of infected cervid carcasses is one of the known risks for introducing CWD prions to new areas. Individual state/provincial/territorial wildlife agencies retain authority for regulation of carcass movement from hunter-harvested North American wild cervids, both intra- and interstate or province. However, regulations vary across states, provinces, and territories, ranging from complete import bans on whole carcasses from any state or province to a ban on importation from known CWD-affected areas (either entire states or identified zones/areas within states and provinces), while others lack any carcass movement restrictions. Several states/provinces restrict the importation of high risk parts such as brain material and spinal columns.

Management strategies and management units/areas of wild cervids varies among states and provinces. Depending on the size of the state, hunting population, harvest numbers, distribution of animals challenges the ability of state/provincial/territorial wildlife agencies to comprehensively test wild cervids for CWD and is often dependent on such factors as current CWD status, agency staffing, budgets, and political influences. Without detailed and current information provided by agency websites, it may be difficult for a nonresident hunter to determine if he/she is in a CWD-affected zone and the import restrictions that apply from their home state/province/territory. The information required for a hunter to remain compliant with CWD regulations, coupled with the increased geographic distribution and prevalence of CWD across North America, requires a more consistent and precautionary approach to cervid carcass movements.

Literature Cited and References

Angers, R. C., S. R. Browning, T. S. Seward, C. J. Sigurdson, M. W. Miller, E. A. Hoover, and G. C. Telling. 2006. Prions in skeletal muscles of deer with chronic wasting disease. Science, 311(5764), 1117-1117.

Kramm, C., S. Pritzkow, A. Lyon, T. Nichols, R, Morales, and C. Soto. 2017. Detection of prions in blood of cervids at the asymptomatic stage of chronic wasting disease. Science Reports, 7(1), 1–8.

Legislation and Regulation

Introduction

The continued spread of Chronic wasting disease (CWD) is one of the most challenging problems facing managers of deer, elk, and other cervids today. Regulating the transport of cervid carcasses as well as specified parts across jurisdictional lines—states, counties, intrastate management areas—is one of the primary means available to reduce CWD spread and subsequent transmission, but existing authorities to regulate such transport vary widely across regions and within states themselves. Litigation in several states continues to raise questions about the jurisdictional authority of state fish and wildlife agencies (SFWAs) to make and enforce such regulations, especially where they affect the nexus of farmed cervids, harvest, and interstate transport.

There are a number of questions to examine in the course of drafting legislation or regulation to regulate transportation and importation, many of which revolve around the project of reclaiming or justifying SFWA authority to regulate live cervids where such authority has eroded.[1]

The socio-legal history of public reaction to these precautionary measures is important to understanding how they have differentiated over time, what sorts of technological and data resources that state agencies and academic institutions may bring to bear, and why we have seen many legislative transfers of jurisdiction over captive cervids to agricultural agencies. These are all important factors that determine SFWAs' ability mitigate the spread of CWD between and among wild and captive herds.

While there is a fair amount of human dimensions research on hunters' perceived risk from CWD and trust in SFWAs to regulate the disease, there is less research on the comparative trust between SFWAs and agricultural agencies, or how hunters assess personal risk versus ecological risk, or the general effects of advocacy by members of the captive cervid industry on the trajectory of regulation in a given state or region. A greater understanding of these dynamics can serve to inform the legislative and/or regulatory process, particularly for more restrictive efforts.

Important state and federal case law

a. *Federal case law*

[1] *See, e.g.*, N.C. S.513 (2015) (transferring North Carolina's captive cervid program from the state's Wildlife Resources Commission to its Department of Agriculture and Consumer Services); W.V. S. 237 (2015) (transferring West Virginia's captive cervid program from the Division of Natural Resources to the Department of Agriculture).

State bans and restrictions on the transportation and importation of cervid parts and carcasses emerge against a backdrop of constitutional limiting principles such as the dormant Commerce Clause, which prohibits state legislation that burdens interstate or foreign commerce.[2] The U.S. Court of Appeals for the Ninth Circuit, for example, has held that state regulations banning the importation of certain wildlife species are not *per se* discriminatory and may therefore pass constitutional muster, as long as such provisions advance a vital state interest that clearly outweighs their impacts on interstate and foreign commerce.[3]

Federal courts disfavor a lack of uniformity, or specific impacts on travel and shipping, and impacts that disproportionately affect out-of-state interests. It is these types of impact that led the Tenth Circuit to hold on one occasion that a state ban on private importation, possession, and management of big game did not regulate in an even-handed manner, and that the state did not demonstrate that the ban was necessary to protect a local interest such as mitigating transmission of diseases between wildlife and domesticated animals.[4]

While there has not been significant dormant Commerce Clause litigation against state restrictions on importation of cervid parts and carcasses, the relevant constitutional principles should be kept in mind throughout the development of legislative or regulatory language. In every instance, a thorough record should be assembled detailing the interest to be protected, including for outright bans, and import permit / veterinary inspection requirements, and exceptions for deboned meat, cleaned skull plates, etc.

b. *State constitutional and statutory case law*

A number of recent cases have sought to ground SFWA regulation of captive cervids, and CWD management, in constitutional authority as well as statute.

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[2] The judicially generated Dormant Commerce Clause is explained succinctly in *Hughes v. Oklahoma*, 441 U.S. 322, 325-26 (1979), in which the U.S. Supreme Court overturned an Oklahoma statute limiting the quantity of minnows that could be transported for sale out-of-state but not limiting what could be traded in-state:

> The few simple words of the Commerce Clause - "The Congress shall have Power…To regulate Commerce…among the several States…" - reflected a central concern of the Framers that was an immediate reason for calling the Constitutional Convention: the conviction that in order to succeed, the new Union would have to avoid the tendencies toward economic Balkanization that had plagued relations among the Colonies and later among the States under the Articles of Confederation. [441 U.S. 322, 326] See H. P. Hood & Sons, Inc. v. Du Mond, 336 U.S. 525, 533 -534 (1949). The Commerce Clause has accordingly been interpreted by this Court not only as an authorization for congressional action, but also, even in the absence of a conflicting federal statute, as a restriction on permissible state regulation.

[3] *Pacific Northwest Venison Producers v. Smitch*, 20 F.3d 1008 (9th Cir. 1994).

[4] *Dorrance v. McCarthy*, 957 F.2d 761 (10th Cir. 1992).

In *Missouri Department of Conservation v. Hill*, Missouri's highest court held in 2018 that "game" and "wildlife" have unambiguous meanings under the state's constitution, therefore the Missouri Conservation Commission, through the Department of Conservation, possesses the authority to regulate captive cervids as game / wildlife.[5] The same year, a lower court in Texas held that Texas Parks & Wildlife Department has the power to "take…and manage any of the wildlife…in this state for investigation, distribution, education, disease diagnosis or prevention, or scientific purposes"—including deer bred under license in which a breeder only has a possessory interest.[6] (This case is undergoing a pending appeal.)

Social and coordinative factors influencing legislative and regulatory change

Efforts to enact legislative restrictions on transportation, especially of carcasses and parts, and to obtain broad acceptance of such restrictions, rely on a number of non-legal factors including hunters' trust in SFWAs, wildlife user values, pressures from litigation, agency culture and relations with users and cervid farmers, and of course the tangible economic impacts of such regulations.

There is generally no central authority to retain cervid import/export data, so labelling of parts and carcasses is of limited use for tracking transportation across state lines. Further limiting factors that SFWA personnel should seek to identify before pursuing additional legislative or regulatory authority to regulate carcass and/or part transport should include:

- Local hunters' trust in SFWAs and agricultural agencies to manage CWD.
- Comparison of local or state regulations among neighboring jurisdictions.
- Local hunters' perception of risks to cervids, humans, and the broader environment associated with CWD.
- Possibility of new rules changing hunter behavior and inducing them to hunt in other areas within a state, or out-of-state, or cease hunting.
- Possibilities of adverse litigation or concurrent counter-legislation.
- The relative influence of stakeholder groups such as hunters, livestock operators, cervid farmers, and landowners.

Reinforcing and filling gaps in existing frameworks

[5] No. SC96739 (Mo. Sup. Ct. 2018). *See also U.S. v. Wainwright*, 89 F. Supp. 3d 950 (S.D. Ohio 2015) (holding that, under the Lacey Act, captive deer are wildlife regardless of their captive origins because they are members of a wild species; "wild animals" includes "wild quadrupeds", which includes "game" and therefore "white-tailed deer").

[6] *Peterson v. Texas Parks & Wildlife*, 03-17-00703-CV (Tex. Ct. App., 3d Dist.) (pending).

Federal regulations apply to the interstate movement of farmed or captive cervids, at 9 CFR parts 55 and 81. The CWD herd certification program (HCP) standards issued by USDA-APHIS implement Part 55 in detail, and rely on state agencies' authorities (whether SFWA or agricultural/animal health) including restrictions on intrastate movement of CWD-positive cervids, requirements to report suspected CWD-positive cervids, implementation of quarantines and other movement restrictions on such cervids and herds, and tracking of owner information, herd program status, individual animal information.[7] As of September 2018, 28 states carry out USDA-approved HCPs.[8]

State and local laws and regulations of farmed or captive cervids that are more restrictive than the federal regulations are not preempted, 9 CFR § 81.6, with the exception that interstate movement of such cervids through more restrictive states to other destinations must be allowed where the cervid is USDA herd-certified, sufficiently identified, and permitted in its destination. § 81.5.

Herd certification requirements include:

- Animal identification before 12 months of age.
- Perimeter fencing "adequate to prevent ingress or egress" of cervids.
- Immediate reporting of all farmed or captive cervid deaths over 12 months of age, as well as escapes/disappearances of any animals, or entry of wild animals.
- Availability of carcasses for tissue sampling and testing.
- Annual updating of herd inventory records.
- Buffer zones of at least 30 feet between fencing surrounding any two herds maintained by one owner, and recording of any movement between the two herds.[9]

For interstate movement of live farmed and wild-caught cervids alike, USDA HCP conditions implementing 9 CFR §§ 81.2-81.3 include:

- Certified status in a federally enrolled and State-approved HCP.
- Sufficient identification and a certificate of veterinary inspection.
- For wild-caught cervids, purpose of establishing or augmenting free-ranging herds.[10]

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[7] U.S. Dep't of Agric., Animal & Plant Health Inspection Serv., *Chronic Wasting Disease Program Standards* at 13-14 (May 2019), *available at* https://www.aphis.usda.gov/animal_health/animal_diseases/cwd/downloads/cwd-program-standards.pdf [hereinafter CWD Program Standards].

[8] U.S. Dep't of Agric., Animal & Plant Health Inspection Serv., *Listing of Approved State CWD Herd Certification Programs (HCPs) – September 2018*, *available at* https://www.aphis.usda.gov/animal_health/animal_diseases/cwd/downloads/approved-state-list.pdf.

[9] CWD Program Standards at 16-17.

[10] *Id*. at 38-39.

Transport of carcasses and parts is *not* covered under the USDA HCP.[11] But these requirements should be seen as reinforcing state SFWA efforts to protect the disease-free status of their wild herds, but lack of uniformity in carcass / part transportation regulations may reduce their effectiveness.

[11] *Id*. at 39.

Model language for transportation of carcasses and parts

As of this writing, bans on the importation of live cervids are in place in 22 states; an import permit is required for live cervids in 28 states, while a certificate of veterinary inspection is required in 26 states, and 15 states require live cervids to originate outside CWD-endemic areas. Half of states require some form of USDA or state herd certification.[12] An individual state's restrictions on the movement of live cervids may affect both the health of wild herds in neighboring states and may also, depending on their strength and the rigor of enforcement, necessitate stricter carcass/part transport regulations. One typical example:

> All live cervids entering [STATE] shall be accompanied by all of the following:
>
> 1. An interstate certificate of veterinary inspection ("ICVI") issued within 30 days prior to arrival, bearing the following statement:
>
>   > All cervidae on this certificate originate from a Chronic Wasting Disease (CWD) monitored or certified herd in which these animals have been kept for at least one year or were natural additions. There has been no diagnosis, signs, or epidemiological evidence of CWD in this herd or any herd contributing to this herd for the previous five years.
>
> 2. For all farmed cervids:
>   a. An individual animal identification as noted on the ICVI.
>   b. A valid transportation permit issued by [AGENCY].
>
> See 2 N.C. Admin. Code § 52B .0213.

Restrictions on the import of carcasses and parts from CWD-endemic areas are in place in 42 states, most of which carve out exceptions for some combination of deboned meat, cleaned skull plates, raw capes/hides, upper canines, and finished taxidermy. A small handful of states (4) make exceptions for expedited processing, while another few states have implemented additional restrictions applying to CWD-adjacent jurisdictions, captive herds, or specific states. About eight states have no ban on import of parts and carcasses.[13]

AFWA's best management practices (BMPs) recommend **(1)** prohibiting the importation of intact cervid carcasses (including spinal column and brain tissue), while allowing for importation of cut/wrapped meat, deboned meat, cleaned skulls or skull caps with no brain material, shed antlers, hides, canine teeth, and finished taxidermy mounts; **(2)** prohibiting the movement of high-risk carcass parts originating from captive facilities from all states and provinces regardless

[12] Analysis on file with authors.
[13] Analysis on file with authors.

of CWD status; and **(3)** providing a program for hunters to report CWD-positive meat and means to destroy such material.[14]

Generally, states that have adopted carcass transportation regulations **do not allow the importation of any brain or spinal column tissue** and allow transport of only the following:

- Meat that is cut and wrapped (either commercially or privately).
- Quarters or other portions of meat with no part of the spinal column or head attached.
- Meat that has been boned out.
- Hides with no heads attached.
- Clean (no meat or tissue attached) skull plates with antlers attached.
- Antlers with no meat or tissue attached.
- Upper canine teeth, also known as "buglers," "whistlers," or "ivories."
- Finished taxidermy.[15]

States may choose to allow importation of quartered carcasses with prohibitions on specific categories of tissue, particularly central nervous or skeletal tissue.[16]

> It shall be unlawful to import, transport, or possess a cervid carcass or part(s) originating from outside of [STATE] except:
>
> 1. Meat that has been boned out such that no pieces or fragments of bone remain.
> 2. Caped hides with no part of the skull or spinal column attached.
> 3. Antlers, antlers attached to cleaned skull plates, or skulls with no meat or brain tissue.
> 4. Cleaned lower jawbone(s) with teeth or cleaned teeth.
> 5. Finished taxidermy products and tanned hides.
>
> See 15A N.C. Admin. Code § 10B .0124 (also including labelling requirements).

States may also prohibit the intrastate movement of intact carcasses and/or parts from CWD-endemic areas.[17]:

[14] Assoc. of Fish & Wildlife Agencies, *AFWA Technical Report on Best Management Practices for Prevention, Surveillance, and Management of Chronic Wasting Disease* 20, Sept. 12, 2018, *available at* https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf [hereinafter AFWA BMPs].

[15] CWD Alliance website, available at http://cwd-info.org/carcass-transportation-regulations-in-the-united-states-and-canada/.

[16] AFWA BMPs at 20.

[17] AFWA BMPs at 20.

> No person shall transport any carcass or part of a carcass of any cervid out of any area designated by [AGENCY] as a disease containment area, except that the carcass parts enumerated in [] may be transported, and carcasses or parts may be transported directly to locations designated by [AGENCY], provided that such carcasses or parts are transported without unnecessary delay and secured within a vehicle or vehicles during transit. Provisions of this section shall not apply to employees of [AGENCY] or another government agency working in an official disease investigation capacity.
>
> See 4 Va. Admin. Code § 15-90-293(D).

States may prohibit importation of intact carcasses from CWD-endemic states and provinces with respect to captive and/or free-ranging populations.[18]

> No person shall import into [STATE] or possess in [STATE] the carcasses of wild, captive, or captive-bred animals of the Genus Cervus or the Genus Odocoileus or the Genus Alces obtained from or taken outside [STATE], except that:
>
> 1. Carcasses of wild animals of the above-named genera taken in the following states and provinces may be imported and possessed provided that all such carcasses are marked as described in [SECTION]:
>   a. [EXEMPT STATE(S)].
>
> See 6 CRR N.Y. § 189.3(e).

A blanket ban on all harvested cervids from all areas regardless of CWD status is also possible.[19]

> No person shall import into [STATE] or possess in [STATE] the carcasses of wild, captive, or captive-bred animals of the Genus Cervus or the Genus Odocoileus or the Genus Alces obtained from or taken outside [STATE].
>
> See 6 CRR N.Y. § 189.3(e).

Directors of SFWAs, where they possess such authority, may also issue executive orders to establish CWD high-risk areas and restrict movements of particular herds, units, or animals.

[18] AFWA BMPs at 21.
[19] AFWA BMPs at 21.

High risk area or county—An area or county that is epidemiologically judged to have a high probability for species susceptible for having, developing, or being exposed to chronic wasting disease (CWD).

Hold order—A document restricting movement of a herd, unit, or individual animal pending the determination of its disease status.

The [DIRECTOR] may issue an order to declare a CWD high risk area or county based on sound epidemiological principles for disease detection, control, and eradication. The criteria used for designating a high risk area or county may include the presence of disease, multiple positive animals in the area, and common animal use practices that could lead to disease exposure.

Such an order shall state the epidemiological criteria for which the order is being issued, a description of the area or county determined to be high risk, a statement that movement of CWD-susceptible species is prohibited if [DIRECTOR] determines that such a prohibition is warranted, and any exceptions, terms, conditions, or provisions prescribed under [GOVERNING STATUTE].

See 4 Tex. Admin. Code § 40.7.

See also:

The [DIRECTOR / OTHER RANKING OFFICIAL] may issue orders prohibiting the importation of certain [farmed] cervids or issue moratoriums pending the investigation of any threat of disease that, based on his or her expertise and experience, poses a risk of spreading disease that will damage or harm the [STATE] farmed cervid industry or [STATE'S] wild herds, including the control or spread of CWD.

See 2 N.C. Admin. Code § 52B .0213.

Next Steps

Chronic Wasting Disease represents one of the most significant challenges to wildlife conservation and management in our time. We therefore encourage state, provincial, territorial, and federal government agencies to adopt and implement policies that will help to reduce the risk of CWD transmission, such as those outlined in the AFWA CWD BMPs and the accompanying Technical Report.

Towards that end, we encourage state agency biologists, veterinarians, and leadership to:

- Carefully review the material and information that has been presented in this strategy document; and
- Compare the best practices outlined here and in the AFWA CWD BMP Technical Report with the existing laws, regulations, and practices that currently govern carcass transport within their state; and
- Collaborate with the biologists, veterinarians, and leadership of adjoining or neighboring states and Canadian provinces to work together to jointly review and examine carcass transport regulations and laws on either side of political boundaries; and
- Work collaboratively across political boundaries in order to make any adjustments to laws and regulations that are deemed necessary in order to reduce the risk of CWD transmission between states, provinces, and territories.

We also encourage the regional associations of state, provincial, territorial, and federal fish and wildlife agencies to initiate and conduct their own regional reviews of carcass transport legislation and regulations, with the goal of assisting the individual states towards achieving consistency and comparability in carcass transport management activities and approaches at broader regional scales.

National Strategy to Reduce Risk of Chronic Wasting Disease Transmission from Movement of Live Cervids

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A Report from the Association of Fish and Wildlife Agencies, Washington, D.C., USA

Background and Purpose of this Document

Chronic Wasting Disease (CWD) is a 100% fatal, transmissible neurodegenerative disease of deer, elk, moose, reindeer, and other species of the family Cervidae. Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden. In areas where CWD has become established, it has emerged as a major threat, reducing the health of cervid populations and causing or exacerbating long-term population declines in the affected species.

To assist state fish and wildlife agencies and partners in managing this disease, the Association of Fish and Wildlife Agencies developed the first-ever set of ***Best Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease*** in 2017-2018 (AFWA CWD BMPs, available online at https://www.fishwildlife.org/application/files/5215/3729/1805/AFWA_CWD_BMPS_12_September_2018_FINAL.pdf). These BMPs are supported by an 111-page technical document that provides additional information about each practice as well as citations to the relevant scientific and technical literature (see: https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf)

The AFWA CWD BMPs identify a set of activities which are known or likely to increase the risk of accelerating or exacerbating the spread of CWD within wild and/or captive cervid populations. In particular, both the transport of infected live animals and the transport of infected animal carcasses or parts are both known pathways by which CWD has been spread within and between cervid populations. Other activities that lead to large or unnatural concentrations of cervids, such as bating or feeding and the use of scent attractants or lures, can also pose an elevated risk of CWD transmission.

In September, 2018, the Directors of the Association of Fish and Wildlife Agencies endorsed the AFWA CWD BMPs and asked the Association's Fish and Wildlife Health Committee to develop four new national strategies that would help state fish and wildlife agencies take steps to reduce the risk of CWD transmission from 1) live animal transport, 2) carcass transport, 3) feeding and baiting, and 4) the use of urine-based scent attractants.

The committee's first step in considering these four topics was to identify mechanisms already in place within state governments that can be utilized or adopted by managers in order to implement strategic practices that will reduce the risk of CWD transmission. As discussed briefly in the AFWA CWD BMP Technical Report, the individual states have already implemented recommendations similar to or identical to those contained in the AFWA CWD BMPs using a variety of available mechanisms, ranging from legislation and regulation in certain states, to voluntary education and outreach measures that engage various user communities.

It is important to note that the available strategies and approaches for implementing particular best practices are generally contingent on the particular political and legislative context of an individual state. We recognize and explicitly state in the AFWA CWD BMP document and Technical Report that the AFWA Best Practices are most definitely not intended to serve as "one size fits all," and that different practices may be appropriate in different states. In many cases, multiple practices were explicitly identified in the AFWA CWD BMP Technical Report, all of which will provide managers with some level of risk reduction, and some of which may be more appropriate or feasible to implement under particular management and regulatory contexts.

Elements of the Strategy

This strategy includes three key components:

1) A statement of the current best practices for reducing risk of CWD transmission from live transport, based on best-available current peer-reviewed science and derived directly from the most recent edition of the AFWA Best Management Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease and accompanying Technical Report, as published on the AFWA website**;**

2) An analysis of current state legislation and regulations regarding live cervid transport, with discussion of differences among states and opportunities to improve or enhance existing state regulations in light of the recommendations contained in the AFWA best practices**;**

3) Sample or model language for state regulations on live cervid transport, for consideration and review by the individual states in order to help to improve alignment of existing regulations with the current best practices for reducing risk of CWD transmission from live cervid transport.

Implementation of the strategic direction outlined in this document is entirely at the discretion of individual states. This document is not intended to replace or supplant any existing law, regulation, or other management directive of any individual state or group of states.

Background Information on Chronic Wasting Disease

What is CWD?

Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy that infects North American deer, elk, moose, and related species (Williams and Miller 2002). This type of pathogen has been documented in mammalian species, including cattle, sheep, humans, and members of the deer family (Cervidae or cervids). The consensus that has emerged from long-term research dedicated to understanding TSEs indicates that prions are the causative agents of all TSEs, including CWD. These prions are misfolded proteins that accumulate in the brainstem and lymphatic tissue of infected animals and results in neurodegeneration and death. Despite extensive development efforts, there are no vaccines or treatments, and no practical live animal or food safety tests for CWD (Gillin and Mawdsley 2018).

Why does CWD matter?

The continued spread of CWD is posing serious threats to wildlife populations and the funds available to manage and conserve wildlife. In states where CWD is established, it has emerged as a major threat, reducing the health of cervid populations and causing long-term population declines (Edmunds et al. 2016; De Vivo et al. 2017). Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden (Gillin and Mawdsley 2018). The introduction of CWD into novel free-ranging deer herds has threatened the sustainability of our wildlife resources and conservation programs and created concerns over the potential implications to human health.

Impacts of CWD:

Wildlife Resource and Hunting

- Chronic wasting disease slowly invades a population and reduces its resiliency. Herds heavily infected with CWD are unable to sustain the combination of disease mortality and hunter harvest (Williams and Miller 2002; Edmunds et al. 2016; De Vivo et al. 2017).
- In states where CWD is established, cervid herds have shown declines of up to 10% a year (Edmunds et al. 2016; De Vivo et al. 2017).
- Once it is widely established, all efforts to eradicate CWD from free-ranging herds have been unsuccessful (Williams and Miller 2002).
- CWD threatens a vibrant hunting community in the United States which provides essential protein resources to many local communities; it is estimated that the nation's 10.9 million white-tailed deer hunters annually harvest 350 million pounds of meat, equating to 1.4 billion meals (Bishop 2010; Southwick Associates 2012).

- CWD also threatens local economies; deer hunting alone contributes an estimated $40 billion to the U. S. economy (Southwick Associates 2012).

Conservation Programs

- In the short term, CWD is causing reallocation of precious financial and staff-time resources and can be widely disruptive to existing programs (Bishop 2010).
- In the longer term, diseases such as CWD pose a threat to the financial cornerstone of fisheries and wildlife programs because sales of deer hunting licenses represent more than 50% of annual revenue (Bishop 2010; Southwick Associates 2012).

Human Health

- There is no evidence to support transmission of CWD from wildlife to humans. However, bovine spongiform encephalopathy, a disease with similar pathogenesis as CWD has resulted in at least 224 people becoming infected with a deadly variant of Creutzfeldt-Jakob disease (Ghani et al. 2000).
- Declining hunting participation has already been documented in states such as Wisconsin because of perceived risk to human health (Bishop 2010).
- The Center for Disease Control and the World Health Organization has recommended against consuming meat from animals infected with CWD (see: https://www.cdc.gov/prions/cwd/index.html).

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A Review of Best Management Practices to Reduce or Minimize the Risk of Chronic Wasting Disease Transmission from the Movement of Live Cervids

The following information is reprinted verbatim from the Technical Report on the AFWA CWD BMPs, which is available for download at https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf

Movement of Live Cervids

Best Management Practice to reduce the risk of CWD transmission and establishment of CWD through the movement of live cervids:

- **To eliminate the risk of anthropogenic movements of CWD in potentially infected live animals, states, provinces and tribes should prohibit the movement of live cervids** including interstate/interprovincial translocations by the captive cervid industry and animal movements undertaken by wildlife management agencies to promote conservation. Similar to the previous chapter, this regulated import action is most effective when employed by states and provinces that do not have CWD documented in their state. However, from a regulation efficiency perspective, a ban across all states and provinces would largely eliminate new cases occurring other than via natural migrations.

Alternative Management practices include:

- **Importation ban on all live cervids from CWD-positive states and provinces where CWD has been detected in either captive or free-ranging cervid populations.** This restriction increases the risk of importing CWD, as CWD-infected animals may migrate from infected states/provinces/areas to adjacent or distant CWD negative areas and subsequently could be moved unknowingly. Also, animals infected in the early stages of the disease may not test positive in antemortem or postmortem diagnostic testing. As stated in previous chapters, certified low-risk herds have consistently been involved in the movement of CWD to new areas. USDA certified low risk captive herds should be rigorously evaluated prior to importation of animals. States/provinces should evaluate the level of risk for importation of CWD they are willing to accept given the shortcomings of the USDA CWD Program Standards, limitations in diagnostic testing of recently infected animals, unknown environmental contamination challenges, and recent repeated relocation of CWD from certified low risk herds.
    - **Due to the increase in positive CWD cases in certified captive herds as part of the federal herd certification program, states and provinces should evaluate their importation policies and standards** (i.e. consider a minimum of 10 years or more for facilities to be CWD free, require importing state/province to have tested all (100%) deceased animals ever residing in a certified facility including slaughter animals and animals sold to shooting facilities, review importing state's /province's import records over time, etc.).

- **Restrict interstate/interprovincial movement of live cervids from states, provinces, territories, or tribal lands to those animals from herds that have had annual CWD testing of the herd for at least 5 years (with a statistical confidence of 95% to find the disease at an occurrence of 1% in the translocated herd) including antemortem testing of entire captive herds and all free-ranging animals being translocated.** It must be noted that this practice provides increased risk from the identified best management practice for moving the pathogen in live animals due to 1) unknown emigration/immigration movements of free-ranging animals into and out of the herd at any point in time; and 2) captive cervid undocumented/illegal transfers, complex and frequent farm-to-farm movements of potentially infected animals, fenceline contact with infected wild animals, infection from environmental contamination; and 3) infected animals which are in the early stages of the disease will not be detected in antemortem testing.

- **Prohibit intrastate, intra-provincial, intra-territorial, and intra-tribal movement of live cervids from CWD enzootic areas.** Similar to the identified best management practice, prohibiting movements of live cervids within the jurisdictional boundaries will reduce the risk of CWD transmission and establishment of CWD through the movement of live cervids. This movement restriction will be most effective when applied directly to CWD enzootic areas/states/provinces.

Supporting Strategies and Evidence

The anthropogenic movement of live cervids is widely considered to be one of the greatest risk factors in spreading chronic wasting disease (CWD) to new areas (Williams et al. 2002; Joly et al. 2003; Travis and Miller 2003; Belay et al. 2004). Natural movements of wild cervids contribute to the spread of the disease (Miller et al. 2000; Conner and Miller 2004; Miller and Williams 2004; Miller et al. 2006; Potapov et al. 2016), and anthropogenic movements of captive and wild animals have the potential to both increase the rate at which the disease is spread and also facilitate introductions of the disease into novel geographic areas (Williams et al. 2002; Belay et al. 2004). Transfer of live animals between captive cervid facilities has been implicated in the introduction of CWD from North America to captive elk facilities in South Korea (Sohn et al. 2002; Williams et al. 2002) and has also been widely implicated in the spread of CWD among captive deer and elk facilities within North America (Williams and Young 1982; Williams et al. 2002; Williams and Miller 2002; Miller and Williams 2004; Belay et al. 2004; Kahn et al. 2004; Sigurdson and Aguzzi 2007). Despite ten years of the USDA APHIS Herd Certification Program, CWD-positive animals are still being detected among certified "low-risk" captive herds. Circumstantial evidence suggests that anthropogenic movements of CWD-infected captive cervids may also have been responsible for the introduction of CWD into naïve wild cervid populations in Canada and the United States, including populations in Saskatchewan (Miller and Williams 2004), Nebraska (Williams et al. 2002), South Dakota (Miller and Williams 2004), and Wisconsin (Joly et al. 2003).

Guidelines and practices for movement of live cervids have been articulated for zoos and similar institutions by Travis and Miller (2003) and for captive facilities by USDA (2014). However, information gained over the last 50 years by scientists indicating an apparent 100% mortality rate among infected animals, a long incubation period for CWD leading to infected, asymptomatic animals shedding prions into the environment through the early course of the disease, a high likelihood of direct or indirect transmission of CWD from infected animals to other captive and/or wild cervids, and the possibility of long-term prion contamination of natural habitats, holding pens,

and facilities occupied by CWD-positive animals (Williams et al. 2002; Travis and Miller 2003; Miller and Williams 2004; Belay et al. 2004; Mathiason et al. 2009), managers and regulators are left with making high-stakes, risk-based decisions when allowing or facilitating the movement of cervids. Additionally, given current limitations in surveillance strategies, budgets, staff capacity, and diagnostic tools, the management option providing the most effective elimination of risk for spreading or acquiring CWD from anthropogenic movements of live animals is simply not to move live cervids.

Federal and State/Province Legal Requirements

Federal legal requirements exist for interstate or interprovincial movement of live captive cervids and wildlife agencies should be familiar with the respective requirements of USDA or CFIA. Individual states and provinces may impose additional regulations on transport of live captive cervids. Transport of game meat and other products derived from captive cervids for purposes of interstate commerce are regulated by the Food and Drug Administration (in U. S.) or by individual provinces (Canada). Similarly, transport of carcasses and other parts derived from hunter-harvested wild cervids, which may contribute to the risk of spread of CWD, are regulated by appropriate state or provincial agencies. In the U. S., Violations of state laws governing transport of cervids may be prosecuted under the federal Lacey Act.

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Legislation and Regulation

Introduction

The continued spread of Chronic wasting disease (CWD) is one of the most challenging problems facing managers of deer, elk, and other cervids today. Regulating the transport of live cervid across jurisdictional lines—states, counties, intrastate management areas—is one of the primary means available to reduce CWD spread and subsequent transmission, but existing authorities to regulate such transport vary widely across regions and within states themselves. Litigation in several states continues to raise questions about the jurisdictional authority of state fish and wildlife agencies (SFWAs) to make and enforce such regulations, especially where they affect the nexus of farmed cervids and interstate transport.

There are a number of questions to examine in the course of drafting legislation or regulation to regulate transportation and importation, many of which revolve around the project of reclaiming or justifying SFWA authority to regulate live cervids where such authority has eroded.[1]

The socio-legal history of public reaction to these precautionary measures is important to understanding how they have differentiated over time, what sorts of technological and data resources that state agencies and academic institutions may bring to bear, and why we have seen many legislative transfers of jurisdiction over captive cervids to agricultural agencies. These are all important factors that determine SFWAs' ability mitigate the spread of CWD between and among wild and captive herds.

While there is a fair amount of human dimensions research on hunters' perceived risk from CWD and trust in SFWAs to regulate the disease, there is less research on the comparative trust between SFWAs and agricultural agencies, or how hunters assess personal risk versus ecological risk, or the general effects of advocacy by members of the captive cervid industry on the trajectory of regulation in a given state or region. A greater understanding of these dynamics can serve to inform the legislative and/or regulatory process, particularly for more restrictive efforts.

Important state and federal case law

a. *Federal case law*

State bans and restrictions on the transportation and importation of live cervids emerge against a backdrop of constitutional limiting principles such as the Commerce Clause and Federal preemption doctrine, which prohibits state legislation that burdens interstate or foreign commerce.[2] The U.S. Court of Appeals for the Ninth Circuit, for example, has held that state regulations banning the importation of certain wildlife species are not *per se* discriminatory and may therefore pass constitutional muster, as long as such provisions advance a vital state interest that clearly outweighs their impacts on interstate and foreign commerce.[3]

Federal courts disfavor a lack of uniformity, or specific impacts on travel and shipping, and impacts that disproportionately affect out-of-state interests. It is these types of impact that led the Tenth Circuit to hold on one occasion that a state ban on private importation, possession, and

[1] *See, e.g.*, N.C. S.513 (2015) (transferring North Carolina's captive cervid program from the state's Wildlife Resources Commission to its Department of Agriculture and Consumer Services); W.V. S. 237 (2015) (transferring West Virginia's captive cervid program from the Division of Natural Resources to the Department of Agriculture).
[2]

[3] *Pacific Northwest Venison Producers v. Smitch*, 20 F.3d 1008 (9th Cir. 1994).

management of big game did not regulate in an even-handed manner, and that the state did not demonstrate that the ban was necessary to protect a local interest such as mitigating transmission of diseases between wildlife and domesticated animals.[4]

While there has not been significant dormant Commerce Clause litigation against state restrictions on importation of live cervids, the relevant constitutional principles should be kept in mind throughout the development of legislative or regulatory language. In every instance, a thorough record should be assembled detailing the interest to be protected, including for outright bans, and import permit / veterinary inspection requirements, and exceptions to comply with existing federal regulation regarding live cervid transport.

b. *State constitutional and statutory case law*

A number of recent cases have sought to ground SFWA regulation of captive cervids, and CWD management, in constitutional authority as well as statute.

In *Missouri Department of Conservation v. Hill*, Missouri's highest court held in 2018 that "game" and "wildlife" have unambiguous meanings under the state's constitution, therefore the Missouri Conservation Commission, through the Department of Conservation, possesses the authority to regulate captive cervids as game / wildlife.[5] The same year, a lower court in Texas held that Texas Parks & Wildlife Department has the power to "take…and manage any of the wildlife…in this state for investigation, distribution, education, disease diagnosis or prevention, or scientific purposes"—including deer bred under license in which a breeder only has a possessory interest.[6] (This case is undergoing a pending appeal.)

Reinforcing and filling gaps in existing frameworks

Federal regulations apply to the interstate movement of farmed or captive cervids, at 9 CFR parts 55 and 81. The CWD herd certification program (HCP) standards issued by USDA-APHIS implement Part 55 in detail, and rely on state agencies' authorities (whether SFWA or agricultural/animal health) including restrictions on intrastate movement of CWD-positive cervids, requirements to report suspected CWD-positive cervids, implementation of quarantines and other movement restrictions on such cervids and herds, and tracking of owner information,

[4] *Dorrance v. McCarthy*, 957 F.2d 761 (10th Cir. 1992).
[5] No. SC96739 (Mo. Sup. Ct. 2018). *See also U.S. v. Wainwright*, 89 F. Supp. 3d 950 (S.D. Ohio 2015) (holding that, under the Lacey Act, captive deer are wildlife regardless of their captive origins because they are members of a wild species; "wild animals" includes "wild quadrupeds", which includes "game" and therefore "white-tailed deer").
[6] *Peterson v. Texas Parks & Wildlife*, 03-17-00703-CV (Tex. Ct. App., 3d Dist.) (pending).

herd program status, individual animal information.[7] As of September 2018, 28 states carry out USDA-approved HCPs.[8]

State and local laws and regulations of farmed or captive cervids that are more restrictive than the federal regulations are not preempted by 9 CFR § 81.6, with the exception that interstate movement of such cervids through more restrictive states to other destinations must be allowed where the cervid is USDA herd-certified, sufficiently identified, and permitted in its destination by § 81.5.

Herd certification requirements include:

- Animal identification before 12 months of age.
- Perimeter fencing "adequate to prevent ingress or egress" of cervids.
- Immediate reporting of all farmed or captive cervid deaths over 12 months of age, as well as escapes/disappearances of any animals, or entry of wild animals.
- Availability of carcasses for tissue sampling and testing.
- Annual updating of herd inventory records.
- Buffer zones of at least 30 feet between fencing surrounding any two herds maintained by one owner, and recording of any movement between the two herds.[9]

For interstate movement of live farmed and wild-caught cervids alike, USDA HCP conditions implementing 9 CFR §§ 81.2-81.3 include:

- Certified status in a federally enrolled and State-approved HCP.
- Sufficient identification and a certificate of veterinary inspection.
- For wild-caught cervids, purpose of establishing or augmenting free-ranging herds.[10]

In implementing proposed BMPs, SFWA should be careful not to enact overly broad prohibitions which may conflict with Federal regulations permitting the interstate movement of cervids as described above.

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[7] U.S. Dep't of Agric., Animal & Plant Health Inspection Serv., *Chronic Wasting Disease Program Standards* at 13-14 (May 2019), *available at* https://www.aphis.usda.gov/animal_health/animal_diseases/cwd/downloads/cwd-program-standards.pdf [hereinafter CWD Program Standards].

[8] U.S. Dep't of Agric., Animal & Plant Health Inspection Serv., *Listing of Approved State CWD Herd Certification Programs (HCPs) – September 2018*, *available at* https://www.aphis.usda.gov/animal_health/animal_diseases/cwd/downloads/approved-state-list.pdf.

[9] CWD Program Standards at 16-17.

[10] *Id*. at 38-39.

Model language for transportation of live cervids

As of this writing, bans on the importation of live cervids are in place in 22 states; an import permit is required for live cervids in 28 states, while a certificate of veterinary inspection is required in 26 states, and 15 states require live cervids to originate outside CWD-endemic areas. Half of states require some form of USDA or state herd certification.[11] An individual state's restrictions on the movement of live cervids may affect both the health of wild herds in neighboring states and may also, depending on their strength and the rigor of enforcement.

While Federal regulation prevents states from expressly prohibiting the interstate movement of live cervids through their state, any preemption issues would be avoided if states were to collectively adopt complete bans on the importation and transportation of live cervids both by captive cervid industry and animal movements undertaken by wildlife management agencies to promote conservation.

A. For the purpose of this regulation, "cervid" means a hoofed mammal that is a member of the Family Cervidae. This includes, but is not limited to, white-tailed deer, mule deer, moose, elk, black-tailed deer, caribou (reindeer), fallow deer, roe deer, musk deer, swamp deer, Pampas deer, tufted deer, red deer, and sika deer.

B. No person shall transport a live cervid into [State] nor shall any person transport, move, or possess any cervid without a permit within [State], except as provided in § C of this regulation.

C. A person may only transport a live cervid continuously through [State] only when transportation is in compliance with all other applicable federal and state law.

See Md. Code Regs.08.03.09.12

AFWA's best management practices (BMPs) recommend **(1)** to eliminate the risk of anthropogenic movements of CWD in potentially infected live animals, states, provinces and tribes should prohibit the movement of live cervids; **(2)** enacting an importation ban on all live cervids from CWD-positive states and provinces where CWD has been detected in either captive or free-ranging cervid populations; **(3)** restrict interstate/interprovincial movement of live cervids to only those animals from herds that have had

[11] Analysis on file with authors.

annual CWD testing of the herd for at least 5 years; or **(4)** prohibit intrastate, intra-provincial, intra-territorial, and intra-tribal movement of live cervids from CWD enzootic areas.[12]

States may choose to prohibit only the importation on all live cervids from CWD-positive states and provinces where CWD has been detected in either captive or free-ranging cervid populations

> (1) Only cervids from "Certified CWD Herds" shall enter [STATE].
>
> (2) All cervids entering [STATE] must meet the minimum certification requirements set forth by the State's Veterinarian
>
> (3) The following requirements shall be included as a part of any certification by the State Veterinarian:
>
> > (a) "All cervids identified on this certificate originate from a Certified herd meeting requirements for certified CWD herd status as determined by the [State] veterinarian." and
> >
> > (b) "No cases of CWD in cervids have been diagnosed within either captive or free-ranging cervid populations of the home state or province of the cervids identified on this certificate".
>
> See 302 Ky. Admin. Regs. 20:066 (2014).

States may also restrict interstate/interprovincial movement of live cervids to only those animals from herds that have had annual CWD testing of the herd for at least 5 years.

> (1) Any cervid species imported into [STATE] shall originate from a herd that has been enrolled in a CWD monitoring program for at least sixty (60) months and which has been determined to have certified CWD free cervid herd status by the animal health official of the state of origin. (5-3-03)
>
> (2) In order to qualify for CWD free status, the records and causes of death for the past five (5) years in the herd shall be made available to the proper State animal health official of the state of origin, and to the State Veterinarian.
>
> See Idaho Admin. Code r. 02.04.21.607

[12] Assoc. of Fish & Wildlife Agencies, *AFWA Technical Report on Best Management Practices for Prevention, Surveillance, and Management of Chronic Wasting Disease* 20, Sept. 12, 2018, *available at* https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf [hereinafter AFWA BMPs].

Finally, states may prohibit intrastate, intra-provincial, intra-territorial, and intra-tribal movement of live cervids from CWD enzootic areas

> All species of cervids, of any age and sex, identified as originating from or documented as having been in or at a location, state, territory, or foreign country that the State Veterinarian determines to be a threat for introducing Chronic Wasting Disease into [STATE] will be banned from entering into [STATE].
>
> See 3 California Code Regs. § 758 (b) (2017).

Next Steps

Chronic Wasting Disease represents one of the most significant challenges to wildlife conservation and management in our time. We therefore encourage state, provincial, territorial, and federal government agencies to adopt and implement policies that will help to reduce the risk of CWD transmission, such as those outlined in the AFWA CWD BMPs and the accompanying Technical Report.

Towards that end, we encourage state agency biologists, veterinarians, and leadership to:

- Carefully review the material and information that has been presented in this strategy document; and
- Compare the best practices outlined here and in the AFWA CWD BMP Technical Report with the existing laws, regulations, and practices that currently govern live cervid transport within their state; and
- Collaborate with the biologists, veterinarians, and leadership of adjoining or neighboring states and Canadian provinces to work together to jointly review and examine live cervid transport regulations and laws on either side of political boundaries; and
- Work collaboratively across political boundaries in order to make any adjustments to laws and regulations that are deemed necessary in order to reduce the risk of CWD transmission between states, provinces, and territories.

We also encourage the regional associations of state, provincial, territorial, and federal fish and wildlife agencies to initiate and conduct their own regional reviews of carcass transport legislation and regulations, with the goal of assisting the individual states towards achieving consistency and comparability in live cervid transport management activities and approaches at broader regional scales.

National Strategy to Reduce Risk of Chronic Wasting Disease Transmission from Baiting Techniques

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A Report from the Association of Fish and Wildlife Agencies, Washington, D.C., USA

Background and Purpose of this Document

Chronic Wasting Disease (CWD) is a 100% fatal, transmissible neurodegenerative disease of deer, elk, moose, reindeer, and other species of the family Cervidae. Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden. In areas where CWD has become established, it has emerged as a major threat, reducing the health of cervid populations and causing or exacerbating long-term population declines in the affected species.

To assist state fish and wildlife agencies and partners in managing this disease, the Association of Fish and Wildlife Agencies developed the first-ever set of ***Best Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease*** in 2017-2018 (AFWA CWD BMPs, available online at https://www.fishwildlife.org/application/files/5215/3729/1805/AFWA_CWD_BMPS_12_September_2018_FINAL.pdf). These BMPs are supported by an 111-page technical document that provides additional information about each practice as well as citations to the relevant scientific and technical literature (see: https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf)

The AFWA CWD BMPs identify a set of activities which are known or likely to increase the risk of accelerating or exacerbating the spread of CWD within wild and/or captive cervid populations. In particular, the use the practice of feeding and "baiting" wild cervids is a significant transmission vector by which CWD has been spread within and between cervid populations. Baiting is the direct or indirect placing, exposing, depositing, distributing or scattering of salt, grain or other feed that could serve to lure or attract cervids to, on or over an area where hunters are attempting to take them. Other activities that lead to large or unnatural concentrations of cervids, such the use of scent attractants or lures, can also pose an elevated risk of CWD transmission.

In September, 2018, the Directors of the Association of Fish and Wildlife Agencies endorsed the AFWA CWD BMPs and asked the Association's Fish and Wildlife Health Committee to develop four new national strategies that would help state fish and wildlife agencies take steps to reduce the risk of CWD transmission from 1) live animal transport, 2) carcass transport, 3) feeding and baiting, and 4) the use of urine-based scent attractants.

The committee's first step in considering these four topics was to identify mechanisms already in place within state governments that can be utilized or adopted by managers in order to implement strategic practices that will reduce the risk of CWD transmission. As discussed briefly in the AFWA CWD BMP Technical Report, the individual states have already implemented recommendations similar to or identical to those contained in the AFWA CWD

BMPs using a variety of available mechanisms, ranging from legislation and regulation in certain states, to voluntary education and outreach measures that engage various user communities.

It is important to note that the available strategies and approaches for implementing particular best practices are generally contingent on the particular political and legislative context of an individual state. We recognize and explicitly state in the AFWA CWD BMP document and Technical Report that the AFWA Best Practices are most definitely not intended to serve as "one size fits all," and that different practices may be appropriate in different states. In many cases, multiple practices were explicitly identified in the AFWA CWD BMP Technical Report, all of which will provide managers with some level of risk reduction, and some of which may be more appropriate or feasible to implement under particular management and regulatory contexts.

At the request of the AFWA Fish and Wildlife Health Committee, AFWA's staff attorney conducted an initial review of the existing state laws and regulations regarding carcass transport, live animal transport, feeding and baiting, and urine. From this review, it was clear that many states have already taken significant steps in crafting laws and regulations designed to reduce the use of baiting as a viable transmission vector for CWD. 27 states currently do not allow baiting of cervids in any forms, and 8 other states only permit baiting in specific areas within the state. This collective effort represents the solid foundation of laws and regulations already developed by state governments, with the goal of presenting a set of tools and approaches that would assist states in implementing the AFWA CWD BMPs related to baiting and feeding.

Elements of the Strategy

This strategy includes three key components:

1) A statement of the current best practices for reducing risk of CWD transmission from baiting and feeding, based on best-available current peer-reviewed science and derived directly from the most recent edition of the AFWA Best Management Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease and accompanying Technical Report, as published on the AFWA website**;**

2) An analysis of current state legislation and regulations regarding baiting and feeding, with discussion of differences among states and opportunities to improve or enhance existing state regulations in light of the recommendations contained in the AFWA best practices**;**

3) Sample or model language for state regulations on baiting and feeding, for consideration and review by the individual states in order to help to improve alignment of existing regulations with the current best practices for reducing risk of CWD transmission through the practice of baiting and feeding. .

Implementation of the strategic direction outlined in this document is entirely at the discretion of individual states. This document is not intended to replace or supplant any existing law, regulation, or other management directive of any individual state or group of states.

Background Information on Chronic Wasting Disease

What is CWD?

Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy that infects North American deer, elk, moose, and related species (Williams and Miller 2002). This type of pathogen has been documented in mammalian species, including cattle, sheep, humans, and members of the deer family (Cervidae or cervids). The consensus that has emerged from long-term research dedicated to understanding TSEs indicates that prions are the causative agents of all TSEs, including CWD. These prions are misfolded proteins that accumulate in the brainstem and lymphatic tissue of infected animals and results in neurodegeneration and death. Despite extensive development efforts, there are no vaccines or treatments, and no practical live animal or food safety tests for CWD (Gillin and Mawdsley 2018).

Why does CWD matter?

The continued spread of CWD is posing serious threats to wildlife populations and the funds available to manage and conserve wildlife. In states where CWD is established, it has emerged as a major threat, reducing the health of cervid populations and causing long-term population declines (Edmunds et al. 2016; De Vivo et al. 2017). Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden (Gillin and Mawdsley 2018). The introduction of CWD into novel free-ranging deer herds has threatened the sustainability of our wildlife resources and conservation programs and created concerns over the potential implications to human health.

Impacts of CWD:

Wildlife Resource and Hunting

- Chronic wasting disease slowly invades a population and reduces its resiliency. Herds heavily infected with CWD are unable to sustain the combination of disease mortality and hunter harvest (Williams and Miller 2002; Edmunds et al. 2016; De Vivo et al. 2017).
- In states where CWD is established, cervid herds have shown declines of up to 10% a year (Edmunds et al. 2016; De Vivo et al. 2017).
- Once it is widely established, all efforts to eradicate CWD from free-ranging herds have been unsuccessful (Williams and Miller 2002).
- CWD threatens a vibrant hunting community in the United States which provides essential protein resources to many local communities; it is estimated that the nation's 10.9 million white-tailed deer hunters annually harvest 350 million pounds of meat, equating to 1.4 billion meals (Bishop 2010; Southwick Associates 2012).

- CWD also threatens local economies; deer hunting alone contributes an estimated $40 billion to the U. S. economy (Southwick Associates 2012).

Conservation Programs

- In the short term, CWD is causing reallocation of precious financial and staff-time resources and can be widely disruptive to existing programs (Bishop 2010).
- In the longer term, diseases such as CWD pose a threat to the financial cornerstone of fisheries and wildlife programs because sales of deer hunting licenses represent more than 50% of annual revenue (Bishop 2010; Southwick Associates 2012).

Human Health

- There is no evidence to support transmission of CWD from wildlife to humans. However, bovine spongiform encephalopathy, a disease with similar pathogenesis as CWD has resulted in at least 224 people becoming infected with a deadly variant of Creutzfeldt-Jakob disease (Ghani et al. 2000).
- Declining hunting participation has already been documented in states such as Wisconsin because of perceived risk to human health (Bishop 2010).
- The Center for Disease Control and the World Health Organization has recommended against consuming meat from animals infected with CWD (see: https://www.cdc.gov/prions/cwd/index.html).

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A Review of Best Management Practices to Reduce or Minimize the Risk of Chronic Wasting Disease Transmission from Baiting and Feeding

The following information is reprinted verbatim from the Technical Report on the AFWA CWD BMPs, which is available for download at https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf

Best Management Practice:

- **To reduce the risk of CWD transmission and establishment of CWD through unnatural concentrations of cervids, states and provinces should eliminate the baiting and feeding of all wild cervids using regulatory mechanisms such as jurisdictional bans.**

Alternative Management practices include:

- **Where a jurisdictional ban is not possible, an alternative utilized by some agencies is to allow baiting and/or feeding of cervids in portions of CWD-positive states where the disease has not yet been detected**. However, this practice may facilitate increasing the prevalence and distribution of CWD within the state due to the epidemiology of the disease, natural movements of cervids, and limitations associated with surveillance of free-ranging animals.

- **In jurisdictions with no evidence of CWD, proactive strategies to decrease baiting and feeding will minimize future disease control challenges**. These strategies may include outright bans as stated above, or aggressive education and outreach campaigns. Once baiting and feeding have been established and hunter attitudes are accepting of the practice, it may be difficult to reverse hunter attitudes even with increasing disease threat.

- **States should provide protocols for alternative methodologies to traditional baited camera surveys for hunters and landowners who wish to survey deer populations on their properties.**

Supporting Strategies and Evidence

From the perspective of control and management of infectious diseases, anything that aggregates animals will, in most circumstances, also increase the opportunity for disease transmission (Becker and Hall 2014). While natural aggregations of animals exist due to a variety of

behavioral, seasonal, and resource factors, human-associated aggregations related to baiting and feeding can greatly increase the risk of disease transmission due to increased animal numbers and concentrations over extended time periods. This can lead to exposure to larger doses of infectious agents, multiple exposures, or exposures sustained over prolonged periods of time all resulting in greater probability of infection.

The provision of food items for cervids and other free-ranging wildlife by humans poses challenges on multiple levels: epidemiologic, ecologic, economic, and social (Brown and Cooper 2006; The Wildlife Society 2007). Baiting (placement of food by humans to aid hunter harvest), recreational feeding (placement of food by humans to aid in wildlife viewing for entertainment), and supplemental feeding (placement of food by humans to increase the nutrition available to wildlife) can all increase transmission of infectious diseases. This occurs by increasing both local densities of animals (and direct contacts between individuals) and environmental contamination with infectious agents (by indirect contacts with food, plants or soils) (Sorensen et al. 2014). Feeding and baiting may change social dynamics among animals and increase contacts between otherwise disparate individuals, groups, or species. Although baiting is far from risk-free, it typically occurs over a shorter period (coinciding with hunting seasons) compared to feeding operations, and may be less of a threat of disease transmission than feeding (Cosgrove et al. 2014). Evidence to date suggests that "restrictions on feeding quantity would not mitigate the potential for disease transmission" and that putative mitigating practices such as spreading feed or bait over a specified area, or restricting the kinds of food items that can be used, did not substantially reduce the potential risk for disease transmission (Palmer and Whipple 2006; Thompson et al. 2008). While proponents often claim that making bait available in areas with enzootic disease is necessary to maintain or increase hunter harvest, current evidence suggests the effect of baiting for increasing harvest is insignificant (Van Deelen et al 2003).

The argument to bait and feed wildlife is often presented by proponents for both economic and social reasons. Sales of wildlife bait and feed provides markets for surplus agricultural commodities considered unfit or unmarketable for human or livestock consumption. Although the economic value of such sales is still largely unquantified, experience in states where baiting and feeding are legal suggest it is substantial. Consequently, bans on baiting and feeding that might decrease sales are typically opposed by farmers and their advocacy organizations. Such groups often exert political pressure on decision makers responsible for wildlife management regulations, arguing bans will result in job losses and decreased economic opportunities in rural areas where hunting is a substantial source of income from tourism.

There is currently no evidence that baiting and feeding of free-ranging cervids can be conducted to mitigate increases in the opportunity for disease transmission. There is also no evidence the practice is likely to increase harvest sufficiently to overcome the negative effects of those increases by disease transmission (Rudolph et al. 2006). Any benefits of increased public support or agency credibility that might theoretically accrue from allowing hunters to use bait remain speculative, and potentially unproven. Research has shown that CWD is both contagious

and self-sustaining (Miller et al. 1998; Miller and Williams 2004; Miller and Wild 2004; Miller et al. 2000). Baiting and feeding deer artificially concentrates deer, facilitating both animal-to-animal contact and exposure to potentially disease-contaminated sites (Garner 2001; Thompson et al. 2008; Mejía-Salazar et al. 2018). A consequence of increased contacts from baiting and feeding is an increased risk of transmission of infectious disease among deer (Thompson et al. 2008; Becker and Hall 2014; Ramsey et al. 2014; Sorensen et al. 2014). An international panel reviewing CWD management in Colorado emphasized that, "Regulations preventing… feeding and baiting of cervids should be continued" (Peterson et al. 2002). In preventing, managing or controlling CWD, states should consider the socio-economic consequences of prohibitions on baiting and feeding.

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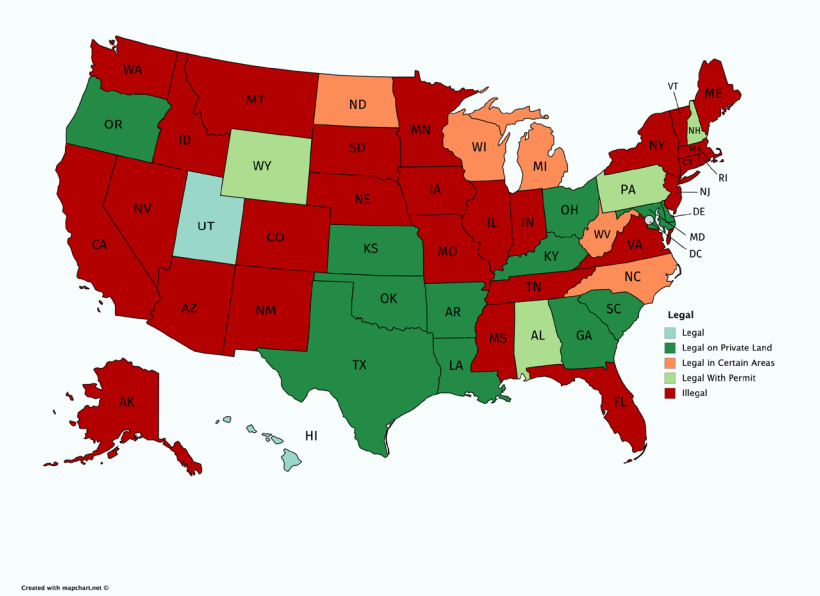
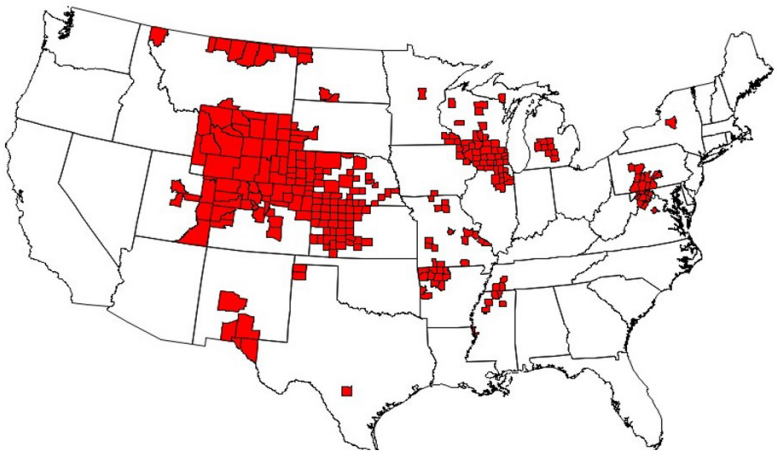
Model language for Restrictions on Baiting and Feeding

As of the time of writing, complete bans on the baiting and feeding of cervids for hunting purposes are in place in 27 states; and all but two states restrict the baiting or feeding of cervids in some form. Many states have entirely prohibited the use of baiting and feeding techniques on public land, and some states have prohibited baiting within specific geographic areas containing CWD-positive cervid populations. An individual state's restrictions on baiting and feeding of cervids may affect both the health of wild cervid populations in neighboring states, given the diffuse nature of CWD. Yet, by comparing the inconsistencies of state regulatory restrictions on baiting and feeding with the prevalence of CWD active populations currently in the United States, it is clear that the CWD-risk to each state does not directly correlate to the severity of restrictions that state will likely place on baiting and feeding techniques .





AFWA's Best Management Practices (BMP) recommends in order to reduce the risk of transmission and establishment of CWD through unnatural concentrations of cervids, that states utilize jurisdiction bans to eliminate the baiting and feeding of all wild cervids. For example:

1. A person shall not:
    (a) Bait big game mammals for the purposes of hunting; or
    (b) Knowingly hunt big game mammals that were baited by another person.
2. For the purposes of this section, "bait" means the intentional placing, exposing, depositing, distributing or scattering of salt, minerals, grain or any other food material, whether natural or manufactured, that could attract, entice or lure wildlife to an area for the purpose of hunting. The term does not include:
    (a) Any incidental attracting or feeding of wildlife associated with any accepted agricultural or livestock practice; or
    (b) Planting crops and leaving those crops standing as food plots for wildlife.

See NV ADC 503.149

However, as discussed in more detail below, the above regulatory provision, does not prohibit the practice of baiting and feeding outside of context of hunting. While most state regulatory provisions restricting baiting are hunting specific, such restrictions still create additional risk of CWD spread through the unnatural concentrations of cervids when baiting is utilized for purposes other than hunting. States should ensure any prohibitions on baiting are sufficiently broad enough to prevent the utilization of baiting techniques in other contexts, for purposes such as out-of-season attractants or for conducting population surveys. States seeking to prevent the spread of CWD by baiting using the strongest possible statutory or regulatory language should consider enacting a provision such as:

1) A person shall not:
    (c) Bait or lure any big game mammals for any purpose; or
    (d) Knowingly allow big game mammals to be baited by another person on their property
2) For the purposes of this section, "bait" means the intentional placing, exposing, depositing, distributing or scattering of salt, minerals, grain or any other food material, whether natural or manufactured, that could attract, entice or lure wildlife to a specific area. The term does not include:
    a. Any incidental attracting or feeding of wildlife associated with any accepted agricultural or livestock practice; or
    b. Planting crops and leaving those crops standing as food plots for wildlife.

As an alternative to AFWA's Best Management Practice, states may seek to prohibit baiting and feeding only on state owned or managed lands with the understanding that further restrictions may need to be implemented as the risk of CWD introduction increases:

(1)(a) The [AGENCY] shall allow the taking of cervids with the use of supplemental feed on private lands and may place any reasonable conditions or restrictions on such taking.

(b) The [AGENCY] shall establish a zone or zones of contiguous counties for the management and implementation of a program to allow the taking of cervids with the use of supplemental feed.

(c) The [AGENCY] shall allow the taking of cervids with the use of supplemental feed on private lands only.

(2) The [AGENCY] shall take any action it deems necessary and use its emergency powers to prevent the introduction of disease, to control disease, to eradicate disease, and to manage the taking of cervids with the use of supplemental feed.

See MS ST § 49-7-33.1

Additionally, a state which finds it has minimal risk of CWD may elect to ban baiting only on public lands, however, such a practice creates a significant risk if it does not provide the agency the authority to eliminate feeding and baiting techniques in certain or all areas in the event of increased CWD or other disease risk to the state's cervid population.

On all [STATE] owned or controlled lands, baiting or hunting over any baited area is prohibited.

See SC ADC 123-40

AFWA also provides Alternative Management Practices which states may decide to supplement or utilize in lieu of the recommended Best Management Practice.

First, states where CWD has been detected may decide to allow baiting and/or feeding of cervids in portions of the state where CWD has not been detected, as determined by the relevant state authority. However, this too, increases risks for CWD-free areas given the diffuse nature of CWD in cervid populations. For example:

Deer baiting and feeding is prohibited in entire counties where any of the following criteria apply:

1. A CWD-affected area has been established in the county or a portion of the county, or

2. A CWD or bovine tuberculosis positive captive or free-roaming, domestic or wild animal has been confirmed after December 31, 1997 from the county, or

3. The county or portion of the county is within a 10-mile radius of a captive or free-roaming, domestic or wild animal that has been tested and confirmed to be positive for CWD or bovine tuberculosis after December 31, 1997.

See WI ADC § NR 19.60

Second, states may seek to utilize proactive strategies to decrease baiting and feeding will minimize future disease control challenges, such as instating a permitting program in instances where the state has decided to permit baiting. A permitting system would have likely had several benefits, including: marginally decreasing the prevalence of baiting practices, giving the state comprehensive information on the prevalence of baiting and feeding, providing an importunity to educate those desiring permits on the CWD risk posed by baiting and feeding practices, and raising revenues from the sale of permits.

(b)(1) This section [banning baiting] shall not apply to a person hunting with the aid of bait on privately owned or leased lands; provided, that the person has purchased, and is in possession of, a bait privilege license issued by the [STATE AGENCY] as follows:

a The annual resident bait privilege license fee shall be [COST], and the issuance of such permit shall be at the discretion of [STATE AGENCY]

b. The annual nonresident bait privilege license fee shall be [COST], and the issuance of such permit shall be at the discretion of the [STATE AGENCY]

c. [STATE AGENCY] may, without refund, suspend the use of a baiting privilege license and adopt rules to manage the feeding of wild game animal populations on a county, regional, or statewide basis to prevent the spread of diseases among wildlife by announcing the suspension in a news release.

See AL ST § 9-11-244

States may elect to permit the use of baiting generally, or in specific circumstances such as for the purpose of conducting a population survey:

> (b)(1) This section [banning baiting] shall not apply to a person utilizing baiting techniques on privately owned or leased lands; provided, that the person has purchased, and is in possession of, a bait privilege license issued by the [STATE AGENCY] as follows:
>
> a The annual resident bait privilege license fee shall be [COST], and the issuance of such permit shall be at the discretion of [STATE AGENCY]
>
> b. The annual nonresident bait privilege license fee shall be [COST], and the issuance of such permit shall be at the discretion of the [STATE AGENCY]
>
> c. [STATE AGENCY] may, without refund, suspend the use of a baiting privilege license and adopt rules to manage the feeding of wild game animal populations on a county, regional, or statewide basis to prevent the spread of diseases among wildlife by announcing the suspension in a news release.
>
> Language altered from AL ST § 9-11-244

Finally, states should provide protocols for alternative methodologies to traditional baited camera surveys for hunters and landowners who wish to survey deer populations on their properties. States should recommend population census strategies such as the Hahn Line, Mobile Line, and Spotlight Census techniques which do not require baiting of cervids to assess population numbers.

Defining "Baiting" In the Regulatory Context

In formulating statutory and regulatory provisions regulating baiting techniques, states should seek to answer three questions: First, what is "baiting"? Second, will the state permit the baiting of cervids in any circumstance? Third, if so, under what circumstances (time, place, method, purpose, state approval) will baiting be permitted? The answers to these questions will depend entirely on the state's own unique circumstances, but states should consider the following implications in answering these questions for themselves.

In determining how a state should seek to define "bait" and "baiting", states should consider, among other things; the current body of scientific evidence establishing the risk posed by unnatural congregations of cervids over baiting areas as a transmission vector of disease, the risk of CWD within the specific state, historic baiting practices within the state, and enforcement feasibility of the proposed regulation by state agencies.

States with CWD-active cervid populations, those with an increased risk of CWD infection, and states seeking to minimize the risk of CWD infection should enact broad definitions of baiting which capture the wide variety of practices that can create unnatural cervid populations. As a best practice, such definitions should include not only the placement of grain and food items, but the use of salts, mineral blocks, or any other consumable substance which could create a transmission vector for CWD or other diseases.[1] Additionally, by expanding the definition of "baiting" outside the context of hunting, states may reduce risk outside of hunting season when the practice may be used to entice cervids into an area prior to hunting season, conduct local population surveys, or simply for the benign purpose of observing wild cervids.[2] The more broadly a state chooses to define baiting, the further the risk of CWD spreading within the state's cervid population may be reduced.

Additionally, states may desire to initially enact a narrow definition of baiting while still retaining the authority to amend any definition in response to heightened risk of disease outbreak like CWD. Just as a state would be prudent to retain the authority to amend regulatory provisions allowing baiting under certain circumstances in light of increased risk, so too would it be prudent for states who choose to utilize a narrow definition of baiting to retain the authority to amend their definition in the event of a change in circumstances, such as the detection of CWD in a previously CWD-free cervid population.

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[1] Palmer, M.V., Whipple, D.L., *Survival of Mycobacterium bovis on Feedstuffs Commonly Used as Supplemental Deed for White-tailed Deer (Odocoileus virginianus)*, 42 J. Wildl. Dis. 853-8 (Oct. 2006).

[2] Cosgrove, M.K., et al, *Baiting and Feeding Revisited: Modeling Factors Influencing Transmission of Tuberculosis Among Deer and to Cattle*, 5 Front Vet. Sci. 306 (2018).

For an example of a broad definition of "baiting", consider the following:

> "Bait" means the intentional placing, exposing, depositing, disturbing or scattering of salt, minerals, grain or any other food material, whether natural or manufactured, that could attract, entice or lure wildlife to an area.
>
> See NV ADC 503.149

Categories of Regulatory Action Over Baiting

The proposed statutory and regulatory examples above demonstrated three different grounds upon which regulatory action over feeding and baiting of cervid populations may be based: by land type (public/private/CWD status), by the type of baiting activity, and by CWD risk. These classifications can be utilized independently or in conjunction with one another to best meet the needs and preferences of each individual state. States should strongly consider increasing restrictive measures based on their current and future risk of CWD infected cervid populations. Moreover, states with existing CWD-active populations should strongly consider a strict prohibition on any and all baiting techniques which may cause the unnatural congregation of cervids and create additional transmission vectors for CWD and other diseases.

Any states which decides to permit baiting in limited or all instances should strongly consider inserting language allowing the state's regulatory agency to suspend any and all baiting techniques in the event that a disease outbreak, CWD or otherwise, is detected. Further, states with a low risk of novel CWD-infection may consider enacting a permitting system which could increase revenue to, among other things, help fund studies of the health of the state's cervid populations. For example, Alabama has established a permitting system, established by § 9-11-244 which permits the Alabama's Department of Conservation and Natural Resources to issue permits allowing hunters utilize baiting techniques.[3] A baiting license can be purchased in the same way as a general hunting license, and DCNR is permitted to adjust the cost of the baiting permit annual pursuant to § 9-11-68.[4] Importantly, the statute also provides DCNR the authority to "without refund, suspend the use of a baiting privilege license and adopt rules to manage the feeding of wild game animal populations on a county, regional, or statewide basis to prevent the spread of diseases among wildlife by announcing the suspension in a news release".[5] This provision is significant, because it expressly empowers the DCNR to suspend any and all baiting practices, regardless of the permit, in light of any disease concerns. The creation of a baiting permitting system is an approach which has multiple practical benefits for states with a relatively

[3] AL ST § 9-11-244 (2019).
[4] AL ST § 9-11-68 (2018).
[5] *Supra* note 3 at § § (c).

low risk of CWD infection because it provides flexibility for states who have historically permitted baiting in some or all instances to adapt to changing conditions or circumstances. Further, it can be utilized in a manner which provides the state with statistical information on the prevalence of the use of baiting techniques within the state and can create a revenue stream that could be utilized to further manage and study the state's cervid populations or to promote better conservation and management practices in general.

Overall, states should be hesitant to enact any statutory or regulatory provisions which fail to provide flexibility to amend or prohibit baiting and feeding techniques when allowed, in light of changing circumstances. States without documented cases of CWD should thoroughly consider the short- and long-term risks of CWD infection in their specific populations when drafting and implement their own baiting regulations. Lastly, states should attempt to thoughtfully engage the hunters and citizens who may be impacted by any new regulatory or statutory provisions, especially when actions represent a departure from established practices, through public information campaigns. This ensures that the public better understands the threat posed by CWD and is more willing to comply with any new state actions involving baiting.

Alternative Strategies to Reduce the Using of Baiting and Feeding Techniques

States who decide to enact measures short of complete baiting bans can still utilize non-statutory measures to reduce the use of feeding and baiting techniques by the general public. One of the most significant challenges facing state agencies in enacting new regulatory provisions limiting or eliminating the using of baiting and feeding techniques is the public pushback which may result from new robust policies.[6] Public information initiatives may play in important role in assuring the success of any future state action restricting baiting practices. Such campaigns should seek to promote ethical and sustainable hunting practices and emphasize the importance of ensuring sustainable and disease-free cervid populations.

Additionally, states can promote alternative practices which foster suitable habitat for cervid populations without creating the additional risk of unnatural congregation sites which serve as transmission vectors. For example, state agencies can promote the creation of food plots, which create less risk of disease transmission than a singular bait site. Additionally, creating and maintaining suitable public lands for deer hunting may reduce the incentives for hunters to utilize bait techniques on small private land tracts.

States should provide protocols for alternative methodologies to traditional baited camera surveys for hunters and landowners who wish to survey cervid populations on their properties. Many state regulatory provisions are specifically targeted at discouraging and eliminating the use of baiting and feeding in the context of hunting, but this may leave open the possibility of landowners using baiting and feeding techniques outside of the hunting season in order to attract

[6] Broom, Brian, *Deer Baiting Survey: "No Consensus*", The Clarion-Ledger (Aug. 15, 2015) ((showing that 52% of respondents favor hunting deer over supplemental feed, while only 37% are opposed)).

and survey deer populations on the property.[7] These practices are likely to create the same level of transmission risk, and states should act to ensure that their regulatory provisions appropriately capture all baiting and feeding practices, whether for the direct purpose of hunting or otherwise. Additionally, states should promote alternative measures for landowners who wish to conduct population surveys on their properties.

By pursuing alternative measures to discourage and disincentivize the use of baiting and feeding techniques, states with a lower risk of CWD-active cervid populations can pursue alternative actions outside of complete prohibitions on baiting and feeding if such a course of action is unrealistic at the time. However, it should be a primary concern to state agencies that should the risk of CWD within the state become significant, that the agencies has the authority to prohibit any practices which would further spread CWD or other diseases within the state's cervid populations.

Next Steps

Chronic Wasting Disease represents one of the most significant challenges to wildlife conservation and management in our time. We therefore encourage state, provincial, territorial, and federal government agencies to adopt and implement policies that will help to reduce the risk of CWD transmission, such as those outlined in the AFWA CWD BMPs and the accompanying Technical Report.

Towards that end, we encourage state agency biologists, veterinarians, and leadership to:

- Carefully review the material and information that has been presented in this strategy document; and
- Compare the best practices outlined here and in the AFWA CWD BMP Technical Report with the existing laws, regulations, and practices that currently govern baiting and feeding practices within their state; and
- Collaborate with the biologists, veterinarians, and leadership of adjoining or neighboring states and Canadian provinces to work together to jointly review and examine baiting and feeding regulations and laws on either side of political boundaries; and
- Work collaboratively across political boundaries in order to make any adjustments to laws and regulations that are deemed necessary in order to reduce the risk of CWD transmission between states, provinces, and territories.

We also encourage the regional associations of state, provincial, territorial, and federal fish and wildlife agencies to initiate and conduct their own regional reviews of baiting and feeding legislation and regulations, with the goal of assisting the individual states towards achieving consistency and comparability in management activities and approaches at broader regional scales.

[7] *Supra* note 2.

National Strategy to Reduce the Spread of CWD via Cervid Urine and Scent Products

A Report from the Association of Fish and Wildlife Agencies, Washington, D.C., USA

Background and Purpose of this Document

Chronic Wasting Disease (CWD) is a 100% fatal, transmissible neurodegenerative disease of deer, elk, moose, reindeer, and other species of the family Cervidae. Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden. In areas where CWD has become established, it has emerged as a major threat, reducing the health of cervid populations and causing or exacerbating long-term population declines in the affected species.

To assist state fish and wildlife agencies and partners in managing this disease, the Association of Fish and Wildlife Agencies developed the first-ever set of ***Best Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease*** in 2017-2018 (AFWA CWD BMPs, available online at https://www.fishwildlife.org/application/files/5215/3729/1805/AFWA_CWD_BMPS_12_September_2018_FINAL.pdf). These BMPs are supported by an 111-page technical document that provides additional information about each practice as well as citations to the relevant scientific and technical literature (see: https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf)

The AFWA CWD BMPs identify a set of activities which are known or likely to increase the risk of accelerating or exacerbating the spread of CWD within wild and/or captive cervid populations. In particular, the use of cervid urine products by hunters creates a significant risk of CWD infections through the introduction of CWD prions within urine into new environments. Additionally, those activities that lead to large or unnatural concentrations of cervids, such the use of both natural and synthetic scent attractants or lures, can also pose an elevated risk of CWD transmission.

In September, 2018, the Directors of the Association of Fish and Wildlife Agencies endorsed the AFWA CWD BMPs and asked the Association's Fish and Wildlife Health Committee to develop four new national strategies that would help state fish and wildlife agencies take steps to reduce the risk of CWD transmission from 1) live animal transport, 2) carcass transport, 3) feeding and baiting, and 4) the use of urine-based scent attractants.

The committee's first step in considering these four topics was to identify mechanisms already in place within state governments that can be utilized or adopted by managers in order to implement strategic practices that will reduce the risk of CWD transmission. As discussed briefly in the AFWA CWD BMP Technical Report, the individual states have already implemented recommendations similar to or identical to those contained in the AFWA CWD BMPs using a variety of available mechanisms, ranging from legislation and regulation in certain states, to voluntary education and outreach measures that engage various user communities.

It is important to note that the available strategies and approaches for implementing particular best practices are generally contingent on the particular political and legislative context of an individual state. We recognize and explicitly state in the AFWA CWD BMP document and Technical Report that the AFWA Best Practices are most definitely not intended to serve as "one size fits all," and that different practices may be appropriate in different states. In many cases, multiple practices were explicitly identified in the AFWA CWD BMP Technical Report, all of which will provide managers with some level of risk reduction, and some of which may be more appropriate or feasible to implement under particular management and regulatory contexts.

At the request of the AFWA Fish and Wildlife Health Committee, AFWA's staff attorney conducted an initial review of the existing state laws and regulations regarding carcass transport, live animal transport, feeding and baiting, and urine. From this review, it was clear that many states have already taken significant steps in crafting laws and regulations designed to reduce the use of cervid urine products as a viable transmission vector for CWD. This collective effort represents the solid foundation of laws and regulations already developed by state governments, with the goal of presenting a set of tools and approaches that would assist states in implementing the AFWA CWD BMPs related to natural cervid urine and scent products.

Elements of the Strategy

This strategy includes three key components:

1) A statement of the current best practices for reducing risk of CWD transmission from the use of urine and scent products, based on best-available current peer-reviewed science and derived directly from the most recent edition of the AFWA Best Management Practices for the Prevention, Surveillance, and Management of Chronic Wasting Disease and accompanying Technical Report, as published on the AFWA website**;**

2) An analysis of current state legislation and regulations regarding the use of urine and scent products, which discusses the variations of regulatory action which states have taken, and how states can model their statutes and regulations to best comport with AFWA Best Management Practices.

3) Sample or model language for state regulations on the use of urine and scent products,

Implementation of the strategic direction outlined in this document is entirely at the discretion of individual states. This document is not intended to replace or supplant any existing law, regulation, or other management directive of any individual state or group of states.

Background Information on Chronic Wasting Disease

What is CWD?

Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy that infects North American deer, elk, moose, and related species (Williams and Miller 2002). This type of pathogen has been documented in mammalian species, including cattle, sheep, humans, and members of the deer family (Cervidae or cervids). The consensus that has emerged from long-term research dedicated to understanding TSEs indicates that prions are the causative agents of all TSEs, including CWD. These prions are misfolded proteins that accumulate in the brainstem and lymphatic tissue of infected animals and results in neurodegeneration and death. Despite extensive development efforts, there are no vaccines or treatments, and no practical live animal or food safety tests for CWD (Gillin and Mawdsley 2018).

Why does CWD matter?

The continued spread of CWD is posing serious threats to wildlife populations and the funds available to manage and conserve wildlife. In states where CWD is established, it has emerged as a major threat, reducing the health of cervid populations and causing long-term population declines (Edmunds et al. 2016; De Vivo et al. 2017). Since its discovery in Colorado in 1967, CWD has spread to at least 26 U.S. states, three Canadian provinces, South Korea, Norway, and Sweden (Gillin and Mawdsley 2018). The introduction of CWD into novel free-ranging deer herds has threatened the sustainability of our wildlife resources and conservation programs and created concerns over the potential implications to human health.

Impacts of CWD:

Wildlife Resource and Hunting

- Chronic wasting disease slowly invades a population and reduces its resiliency. Herds heavily infected with CWD are unable to sustain the combination of disease mortality and hunter harvest (Williams and Miller 2002; Edmunds et al. 2016; De Vivo et al. 2017).
- In states where CWD is established, cervid herds have shown declines of up to 10% a year (Edmunds et al. 2016; De Vivo et al. 2017).
- Once it is widely established, all efforts to eradicate CWD from free-ranging herds have been unsuccessful (Williams and Miller 2002).
- CWD threatens a vibrant hunting community in the United States which provides essential protein resources to many local communities; it is estimated that the nation's

10.9 million white-tailed deer hunters annually harvest 350 million pounds of meat, equating to 1.4 billion meals (Bishop 2010; Southwick Associates 2012).
- CWD also threatens local economies; deer hunting alone contributes an estimated $40 billion to the U. S. economy (Southwick Associates 2012).

Conservation Programs

- In the short term, CWD is causing reallocation of precious financial and staff-time resources and can be widely disruptive to existing programs (Bishop 2010).
- In the longer term, diseases such as CWD pose a threat to the financial cornerstone of fisheries and wildlife programs because sales of deer hunting licenses represent more than 50% of annual revenue (Bishop 2010; Southwick Associates 2012).

Human Health

- There is no evidence to support transmission of CWD from wildlife to humans. However, bovine spongiform encephalopathy, a disease with similar pathogenesis as CWD has resulted in at least 224 people becoming infected with a deadly variant of Creutzfeldt-Jakob disease (Ghani et al. 2000).
- Declining hunting participation has already been documented in states such as Wisconsin because of perceived risk to human health (Bishop 2010).
- The Center for Disease Control and the World Health Organization has recommended against consuming meat from animals infected with CWD (see: https://www.cdc.gov/prions/cwd/index.html).

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A Review of Best Management Practices to Reduce or Minimize the Risk of Chronic Wasting Disease Transmission from Cervid Urine Products Related to the Introduction of Prions to the Environment

The following information is reprinted verbatim from the Technical Report on the AFWA CWD BMPs, which is available for download at https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf

Best Management Practice:

- **Eliminate the sale and use of natural cervid urine-based products**. Banning urine-based products is the only practice that would completely ~~reduce~~ eliminate the risk of importing CWD via these products. This BMP would be most effective in those states and provinces that do not have documented cases of CWD. A comprehensive ban on sales and use would be the simplest and easiest regulation for hunters to understand and agencies to enforce. It is strongly recommended that agencies reach out to hunting groups prior to any ban to explain the risks associated with natural deer urine products. The restriction will likely be opposed by captive cervid operators and producers. Many archery and firearm hunters utilize scent lures as a hunting tool where it is legal and will likely oppose any rule change.

Potential alternatives if a complete ban is not an option:

- **Permit the sales and use of synthetic scent products**. Fully synthetic scent products ~~would be~~are a safe alternative relative to CWD risk. However, because there is no way to differentiate synthetic products from natural urine, there ~~would~~ is a risk of natural urine being dispensed as a synthetic. Currently, labeling of urine scents is not uniform and it may be difficult to ascertain the purity of the product. This creates challenges for users ~~and also~~and ~~for~~ agencies attempting to enforce~~ment~~ of urine restrictions.

- **Permit only cervid urine products produced in-state/in-province/in-territory to reduce the risk of importing contaminated product from an unknown source**. States/provinces permitting urine production should have rigorous regulation of live cervid~~s~~ importation and active CWD surveillance programs. The regulatory frameworks which would be needed to facilitate the use of such products may require significant agency effort while only marginally reducing the potential risk of prion introduction.

Commented [LK1]: What are the risks of an in-jurisdiction production system? Seems like the ones detailed immediately below would apply to this option.

- **Allow import of natural urine-based products from states and provinces without CWD detections.** There is currently no agency oversight of the production, bottling, distribution, or sale of urine-based products or mechanisms to provid~~e~~ing quality assurance/quality control to ensure that these products are actually CWD-free. Similarly, there are no existing mechanisms ~~where~~ for agencies to~~could~~ recall CWD-contaminated

products once distributed. Like in-state product restrictions, this alternative entails significant regulatory framework to ensure proper monitoring and enforcement on behalf of the agency and does little to effectively minimize the risk of prion introduction. Therefore, this alternative is higher risk than ~~a complete ban.~~other alternatives.

Supporting Strategies and Evidence

Prions have been detected in saliva, feces, blood, antler velvet, and urine (Angers et al. 2006, Angers et al. 2009, Haley et al. 2011, Henderson et al. 2015, Mathiason et al. 2006, Plummer et 25 al. 2017). Infected deer may shed prions in their urine for months (or years) prior to developing clinical signs and may shed thousands of infectious doses of prion over the course of a shedding animal's life (Henderson et al. 2015).

Despite federal, state, and local laws, regulations and other measures intended to prevent the spread or reduce CWD prevalence, the disease continues to be identified in new areas, including in captive cervid facilities certified as "low risk" through the USDA Herd Certification Program (HCP) and the CFIA Voluntary Herd Certification Program (VHCP). More restrictive CWD regulations on the sales and use of potentially infected materials are needed to stop actions that could infect wild and captive cervid herds now and for future generations. Multiple states and provinces have already implemented bans on natural cervid urine products (e.g., Alaska, Arkansas, Arizona, New Mexico, Vermont, Virginia, Manitoba, Nova Scotia, Ontario, and Yukon Territory). The Northeast Association of Fish and Wildlife Agencies passed a resolution strongly encouraging all state and provincial fish and wildlife agencies to work diligently to ban the use of natural-based cervid urine products (Adopted Nov. 1, 2017 http://www.neafwa.org/uploads/2/0/9/4/20948254/deer_urine_2017.pdf).

Urine sold commercially is collected from captive cervid facilities. Extensive movement of animals between facilities, limited and delayed testing of animals, and shared equipment between breeder herds and shooting herds make captive cervids a high risk for CWD (Maddison et al. 2010). Nationally, CWD continues to be found in captive cervid facilities with 40 facilities testing positive since 2012 in 9 states. Of the CWD positive facilities, 12 were shooter facilities and 27 were breeder facilities; 18 of 27 had at least 5 years of monitoring (testing mortalities) and 15 of 27 were enrolled in the USDA HCP. Urine products are frequently batched/combined from multiple locations and distributed across the country via retail, internet, and catalog sales (Nark 2017). Urine production and sales is not regulated by any agency, nor are there any testing or marking requirements ~~of~~ for urine products. The Archery Trade Association Deer Protection Program is modeled after the USDA HCP but has no regulatory authority to provide an adequate prevention and distribution of contaminated urine products.

CWD prions are excreted in higher concentrations in saliva and feces than in urine (Henderson et al. 2015, Plummer et al. 2017). Urine is often collected through a grate system, which allows mixing of saliva and feces with the urine prior to filtering (Spitznagel 2012). This mixing could increase the likelihood of CWD-infected urine with higher concentrations of prion entering the scent market. There is currently no rapid, cost~~-~~effective test to determine ~~if~~ whether collected urine contains prions (John et al. 2013). Therefore, although the risk of CWD transmission by urine products or a single application of a urine product to a surface is relatively low compared to movement of live cervids or carcasses, regulation of this industry is lacking

Commented [LK2]: Are there other (non-CWD-related) cases of recreational products being recalled out of concern for the health of a wildlife population? If so, it might be interesting to include an example of a state or federal natural resource agency working on its own or partnering with some other consumer/regulatory agency to implement a recall.

Commented [BN3R2]: The closest allegory I can think of is federal and state restrictions on lead-based ammunition, but I'm not sure how relevant that framework would be here. I'm happy to explore this more thorough if you think it may be useful.

with no known no “safe” dose of prion; exposure to one prion may be enough to cause infection (Fryer and McLean 2011). Additionally, the repeated application of urine scents to a defined surface (same tree for instance) or in the same area over time by an archery or rifle hunter produces increased risk because the multiple applications may be increasing the loading or infective dose at the attraction 26 site by a susceptible ungulate. The environmental persistence of the applied prions could well serve as the point source of an infection outbreak.

Prions readily bind to soil minerals where they remain infectious (Johnson et al. 2006). If cervid urine containing prions is put on the landscape by deer hunters (e.g., in a scrape or other area used by cervids), prions may bind to soil and contaminate that location for years or decades. Models have demonstrated that risk of CWD transmission from the environment increases over time as prions accumulate (Almberg et al. 2011). Repeated applications of deer urine at the same place over time could potentially build a reservoir of prions, increasing the likelihood of transmission (Mathiason et al. 2009). Plants are capable of binding prions on leaves and taking up prions into their tissues; those prions remain infectious (Pritzkow et al. 2015) although the uptake or effect in wild deer is unknown. Cervids attracted to scent location could potentially ingest prions in plants or soil and become infected.

In addition to the risks associated with the product itself, cervid urine placed by humans serves as another unnatural attractant to artificially congregate animals. In areas where CWD is present, urine may facilitate disease transmission to healthy animals, much like supplemental feeding or baiting.

State agencies that have attempted to or have implemented bans on natural urine products have experienced variable levels of negative feedback from hunters. However, some surveys suggest that hunters may be open to restrictions on the use of these products. Nationally, 82% of hunters surveyed from the National Deer Alliance have used natural urine products in the past, but despite having a history with these products, 80% still supported a ban to prevent CWD introduction (n=516, Schuler, personal communication). Synthetic urine products represent over 20% of the current market so safer alternative product is available although testing and regulation of the product and industry does not currently exist.

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State Diversity on the Regulation Cervid Urine Products

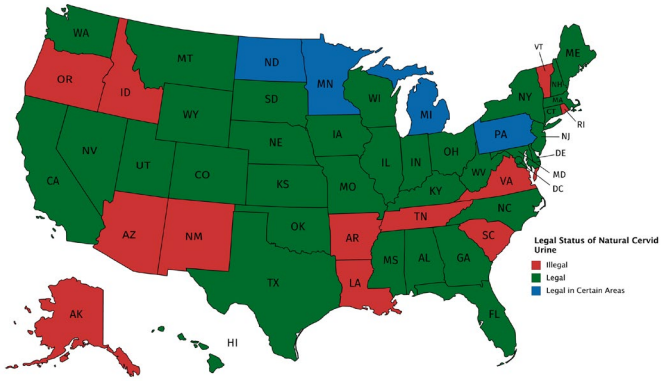
As of the time of writing, 38 states currently allow at least some use of natural deer urine as an attractant by hunters.

States ~~which~~ that currently permit the use of natural cervid urine and scent products include: Washington, California, Montana, Wyoming, Nevada, Utah, Colorado, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Iowa, Missouri, Wisconsin, Illinois, Indiana, Ohio, Kentucky, North Carolina, Georgia, Florida, Alabama, Mississippi, West Virginia, Maryland, Delaware, New Jersey, Connecticut, Maine, Pennsylvania, New York, Massachusetts, and New Hampshire.

Some states have chosen to limit the use of these products in areas with active CWD outbreaks. Michigan, Minnesota and North Dakota limit the use of natural urine products in areas with a prevalence of CWD.

The following states do not allow the use of natural scents and urines: Alaska, South Carolina, Idaho, Arizona, New Mexico, Oregon, Arkansas, Louisiana, Tennessee, Virginia, Vermont and Rhode Island.

On the next page, a map of the distribution of state laws governing the use of natural scents and urines is followed by a map showing current CWD-active counties in the United States.



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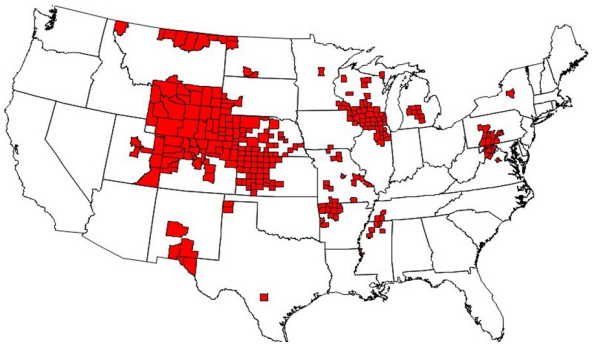

Model Language for Regulating Cervid Urine Products

In order to reduce the spread of CWD caused ~~by~~ both by CWD prions being introduced into a previously CWD-free environment, and ~~through~~ by the unnatural congregation of wild cervids ~~caused by~~through the use of urine and natural scent lures, states should consider adopting statutory and regulatory provisions ~~which align~~consistent with AFWA's Best Management Practices.

The following is a model regulatory provision which would prohibit the use of any natural cervid urine or scent product in any hunting or surveillance context. This provision should be considered by states seeking to adopt the AFWA's Best Management Practices and reduce the possibility of CWD prions being introduced into the environment and transmitted to previously CWD-free cervid populations.

The [AGENCY] finds that, in order to protect the health of cervids in [STATE], it is necessary to prohibit the use of cervid urine, blood, glands, gland oil, feces, or other bodily fluids for the purpose of taking or attempting to take any cervids within [STATE].

1) Restricted and Permitted Uses of cervid urine, blood, glands, gland oil, feces, or other bodily fluids.
    a. No person shall possess while hunting or use, for the purposes of taking or attempting to take, attracting, surveillance or scouting deer; any product that contains or purports to contain any cervid urine, blood, gland oil, feces, or other bodily fluids.

Adopted from Vt. Admin. Code 16-4-128:14.0

In determining the extent of regulation over natural urine and scent products, states will likely be forced to choose whether to allow the use of synthetic urine and scent products or to prohibit the use of synthetic products in addition to natural urine and scent products. Many states ~~who~~ that have prohibited natural cervid urine and scent products have chosen to permit the continued use of synthetic products, but this decision may still risk the unnatural congregation of cervids in the wild leading to an increased potential of CWD transmission between animals.

States ~~who~~ that do not wish to ban the use of natural cervid urine and other scent products entirely may choose to take action to permitting only cervid urine products produced in-state/in-province/in-territory from certified CWD-free facilities in order to reduce the risk of importing contaminated product from an unknown source or introducing CWD prions into the environment from captive cervid populations. States will likely need to set their own requirements for certifying which products or facilities may be approved within the state/province/territory, but the following regulatory provision would prohibit the use of any natural urine or scent products not certified by the relevant state agency:

1) No person shall possess while hunting or use, for the purposes of taking or attempting to take, attracting, surveillance or scouting deer; any product not approved for use by [STATE AGENCY] which contains or purports to contain any cervid urine, blood, gland oil, feces, or other bodily fluids.

Finally, states may elect to allow for the importation of natural urine-based products from other states and provinces without CWD detections. There is currently no agency oversight of the production, bottling, distribution, or sale of urine-based products or mechanisms providing quality assurance/quality control to ensure that these products are actually CWD-free. Similarly, there are no existing mechanisms where agencies could recall CWD-contaminated products once distributed. Therefore, this alternative is higher risk than either a complete ban or additional limitations discussed above. The risks posed by both efforts to regulate natural urine products both internally produced and imported are detailed more thoroughly below.

The extent to which individual states will choose to regulate cervid urine and scent products will inevitably vary based on the state's specific circumstances. For example, states with current CWD-active cervid populations will likely need to enact stricter regulatory measures over urine and scent products to reduce the risk of both additional CWD prions being introduced to the environment and the creation of new transmission vectors through an unnatural congregations of wild cervids created by the use of these products. States without documented CWD-active populations may choose to prohibit only the use of natural products while permitting the use of synthetic urine products, thereby eliminating the risk of introducing CWD prions into the environment.

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Risks of Permitting Natural Scent Products Under a Model Regulatory Framework

States and Provinces that elect to allow the use of those natural cervid scent or urine products which satisfy that jurisdiction's regulatory requirements may create additional agency burdens while only marginally decreasing the risk of introduction of CWD prions into the environment. Specifically, attempts to facilitate the production and use of products in compliance with model regulations would first require the state to create and enact a regulatory framework ~~which~~ governing the production, sale, and use of such products. Both in-jurisdiction regulatory frameworks and those that permit the importation of scent or urine products would constitute novel efforts to regulate such products and would not benefit from modeling their framework and enforcement system after established regulatory efforts, as none currently exist.

States and Provinces seeking to craft a regulatory model permitting the production, sale, and use of these products only within the jurisdiction of the state, while perhaps limiting exposure to imported products containing CWD prions, would still be tasked with crafting and implementing both a regulatory framework that producers, businesses, and hunters could comply with, but additionally with creating monitoring and enforcement mechanisms to ensure compliance with any regulations. Indeed, monitoring the production and sale of these products successfully would likely require significant effort on the part of state agencies. Moreover, monitoring the use of only those products produced in-state and in conformity with established guidelines creates another layer of difficulty, as it may be difficult for both hunters and law enforcement to understand and distinguish between conforming and non-conforming products. States electing to only permit the use and sale of synthetic products would avoid the significant burdens inherent ~~to~~in permitting the use of some natural scent products, while likely creating a greater reduction in the risk of introduction of CWD prions into the environment.

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Finally, states and provinces electing ~~the~~to permit natural cervid scent products produced outside the state would, like states permitting only in-state product use, need to establish significant and model regulatory and enforcement frameworks. Additionally, these states would have even greater difficulty ensuring compliance with any regulations crafted to ensure no CWD prions were present in permitted products as any access or control over out-of-state producers would be significantly limited. Like the in-jurisdiction option, this option appears to create significant costs and burdens on agencies while only marginally decreasing risk of prion introduction.

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Next Steps

Chronic Wasting Disease represents one of the most significant challenges to wildlife conservation and management in our time. We therefore encourage state, provincial, territorial, and federal government agencies to adopt and implement policies that will help to reduce the risk of CWD transmission, such as those outlined in the AFWA CWD BMPs and the accompanying Technical Report.

Towards that end, we encourage state agency biologists, veterinarians, and leadership to:

- Carefully review the material and information that has been presented in this strategy document; and
- Compare the best practices outlined here and in the AFWA CWD BMP Technical Report with the existing laws, regulations, and practices that currently govern the use of cervid urine and scent products within their state; and
- Collaborate with the biologists, veterinarians, and leadership of adjoining or neighboring states and Canadian provinces to work together to jointly review and examine the regulations and laws on either side of political boundaries; and
- Work collaboratively across political boundaries in order to make any adjustments to laws and regulations that are deemed necessary in order to reduce the risk of CWD transmission between states, provinces, and territories.

We also encourage the regional associations of state, provincial, territorial, and federal fish and wildlife agencies to initiate and conduct their own regional reviews of legislation and regulations, with the goal of assisting the individual states towards achieving consistency and comparability in management activities and approaches at broader regional scales.

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

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Bird Conservation Committee
Education, Outreach, and Diversity Committee
Fish and Wildlife Health Committee
Invasive Species Committee
Legal Committee

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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 actively engaged in this issue and Work Group, and representing a variety of state, federal, and non-governmental partners across North America. 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.

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).

Case Study (sidebar section)

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. (2013) 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. 2013).
(end sidebar)

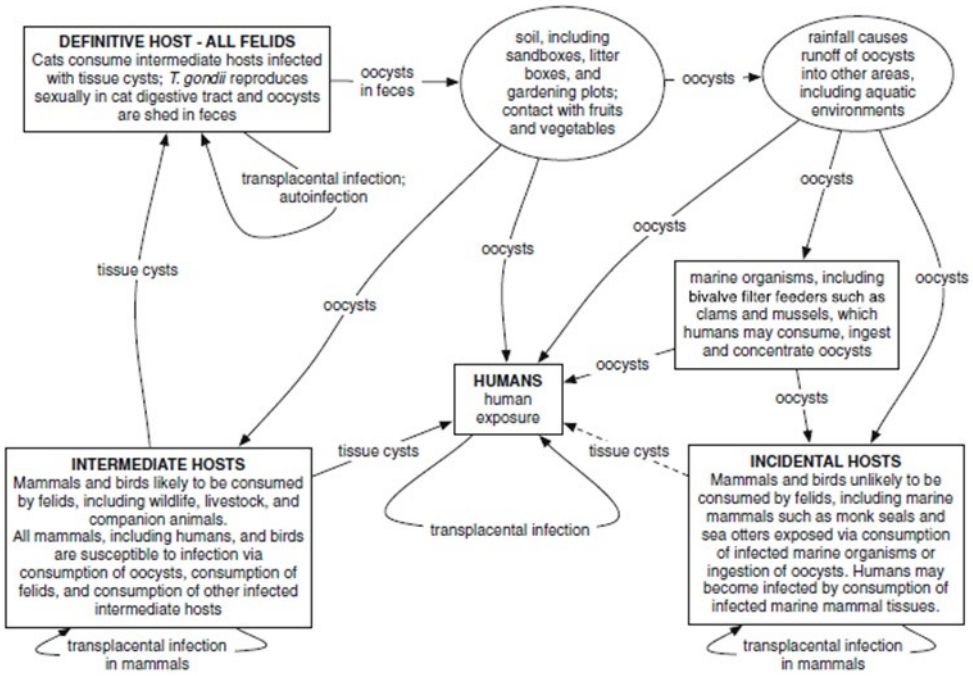

Figure 1. Life cycle of *Toxoplasma gondii* and transmission pathways in humans, domestic animals, and wildlife (Aguirre et al. 2019). Figure used with permission from authors.

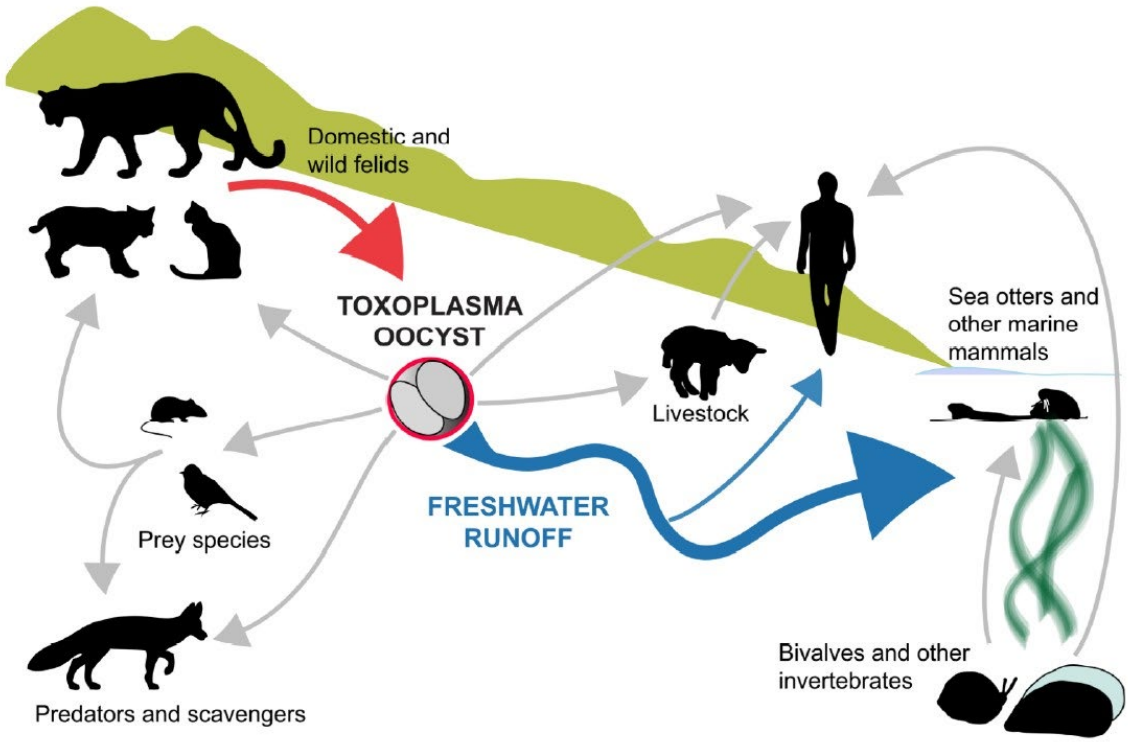

Figure 2. Environmental transmission pathway of *Toxoplasma gondii* from terrestrial to marine ecosystems (VanWormer et al. 2013).

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-roaming 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, Taetszh 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).

Case Study (sidebar section)
A strategic approach used to control the spread of 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 (P*anthera onca*), lynx (*Lynx canadensis*), and ocelot (*Leopardus pardalis*).
(sidebar ends)

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.

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 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 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 cats from rabies booster requirements, violated state law. The Court disagreed and dismissed the suit.

Inks v Gaydos-Behanna Kennel | Filed: 2018 | Ruling:
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:
State: South Carolina
Beaufort County, SC, residents Stephen and Barbara Bischoff sued The Crazy Crab for damages due to injuries inflicted by a feral 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 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. 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.

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 on both sides 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.

What's in a name? (Sidebar section)

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:

At-large cat – 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.
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; may include stray cats or feral cats
Feral cat – a domestic cat living in a wild state; unhabituated to people; roams outdoors without restriction; may live far away from human settlements
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
Stray cat – a domestic cat that lives exclusively outdoors; habituated to people; roams outdoors without restriction
(end sidebar)

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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 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.

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).

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.
Hawai‘i	Cats and Wildlife Coalition	American Bird Conservancy, county humane societies, Hawai‘i Cat Foundation,	Partner organizations sought to "develop and implement collaborative efforts among wildlife managers and

		Hawai‘i Department of Land and Natural Resources (DLNR), Humane Society of the United States, National Oceanic and Atmospheric Administration, National Park Service, The Wildlife Society – Hawai‘i Chapter, U.S. Fish and Wildlife Service	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.
Hawai‘i	Kaua‘i Feral Cat Task Force	American Bird Conservancy, Best Friends Animal Society, County of Kaua‘i, Hawai’i DLNR, Hanalei Watershed Hui, Hawaiian Humane Society, Hui Ho‘omalu i ka ‘Aina, Humane Society of the United States, Kaua‘i Albatross Network, Kaua‘i Ferals, Kaua‘i Humane Society, Kaua‘i Invasive Species Committee, National Park Service, Paradise Animal Clinic, University of Hawai‘i, U.S. Fish and Wildlife Service	Convened by the County of Kaua‘i, this task force made recommendations in 2014 for the purpose of Kaua‘i becoming “free of feral, abandoned, and stray” domestic cats (Adler 2014).
Hawai‘i	Toxoplasmosis and At-large Cat Technical Working Group (TACTwg)	City and County of Honolulu, County of Maui, Hawai‘i DLNR, Office of Hawaiian Affairs, National Oceanic and Atmospheric Administration-Fisheries, National Park Service, U.S. Fish and Wildlife Service, U.S. Army Garrison Hawai‘i, U.S. Department of Agriculture Animal and Plant Health Inspection Service, U.S. Geological Survey, U.S. Marine Corps Base Hawai‘i, U.S. Naval Facilities Hawai‘i 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 Hawai‘i, 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 (sidebar section)
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.
[include Lanai Cat Sanctuary photo]
(end sidebar)

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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Keitt B., N. Holmes, E. Hagan, G. Howald, and K. Poiani. 2019. Going to scale: reviewing where we've been and where we need to go in invasive vertebrate eradications. Pp. 629-632 *in* Island Invasives: Scaling up to Meet the Challenge (C.R. Veitch, M.N. Clout, A.R. Martin, J.C. Russell, and C.J. West, Eds.). Gland, Switzerland: IUCN.

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, 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.

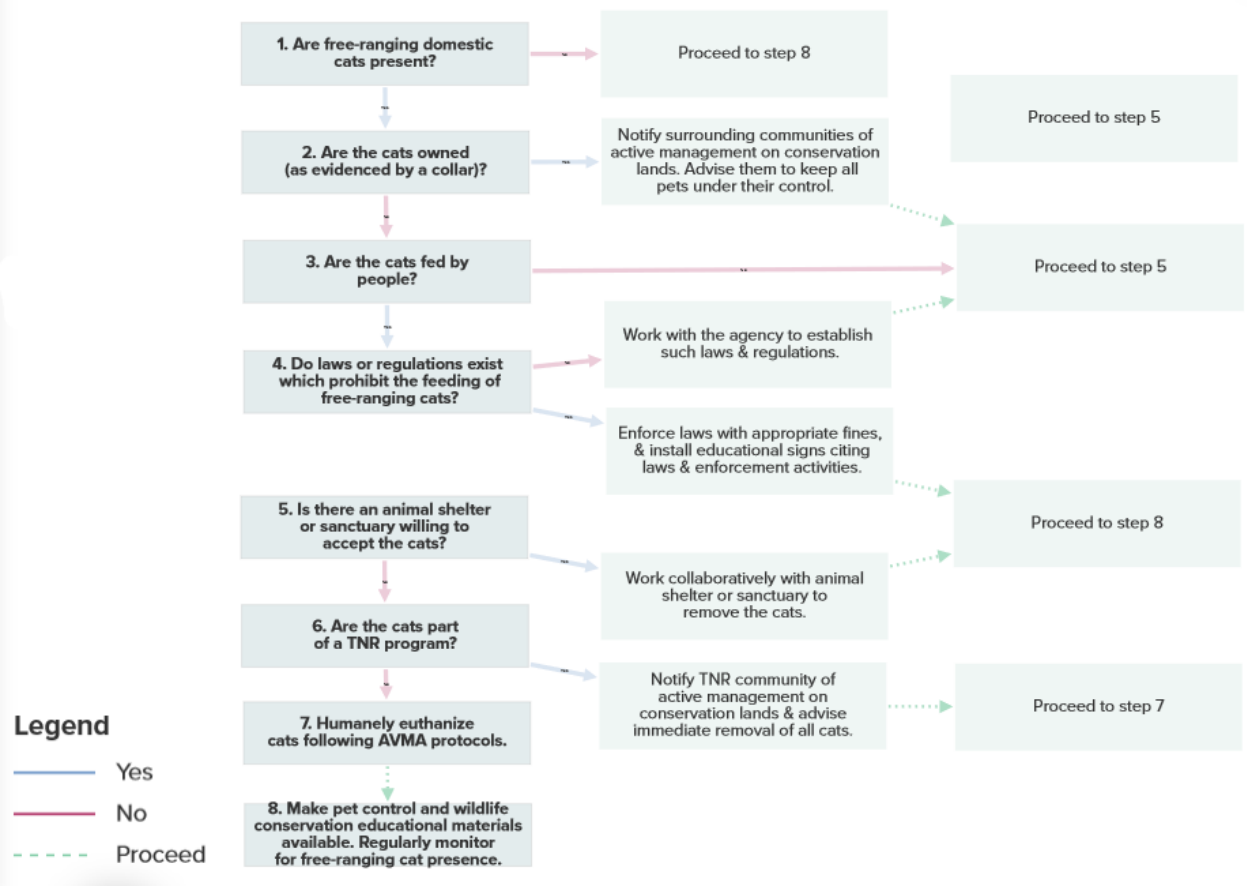

Figure 3. Domestic cat management decision tree.

Prevention

While efforts to prevent the presence of domestic cats on wildlife conservation lands may not be foolproof, they 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 cats and delivery for adoption is an excellent management strategy. Efforts should be made to ensure adopted 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 cat-proof enclosure may be constructed to temporarily or permanently house live-captured cats. Enclosures may be constructed on wildlife conservation lands, or cats may be transported to existing off-site enclosures, such as cat sanctuaries (e.g., Lāna'i 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 Association (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.

[photo of cat exclosure]

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).

Case study (sidebar section)
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 cat 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.

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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).

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).

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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

DISEASES OF CATS						
TYPE OF DISEASE	**AGENT**	**TRANSMISSION**	**ZOONOTIC**	**CAT CLINICAL SIGNS**	**TREATMENT**	**PREVENTION**
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
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

DISEASES OF CATS						
TYPE OF DISEASE	**AGENT**	**TRANSMISSION**	**ZOONOTIC**	**CAT CLINICAL SIGNS**	**TREATMENT**	**PREVENTION**
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