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Wildlife Services
Research Needs Assessment
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2016 WILDLIFE SERVICES RESEARCH NEEDS ASSESSMENT

ABSTRACT

The Wildlife Services (WS) program of the U.S. Department of Agriculture provides Federal leadership and expertise in managing problems caused by wildlife. The National Wildlife Research Center (NWRC), the research arm of WS, applies scientific expertise to the development of practical methods to resolve problems caused by the interaction of wild animals and society. Approximately every 5 years WS conducts a research needs assessment (RNA) to identify priority research needs of stakeholders. The results of the RNA, together with guidance from Congress and the WS Deputy Administrator, help establish research priorities at the NWRC. The most recent RNA, conducted in 2016, solicited information from the WS Operations program, NWRC research scientists, and selected external stakeholders. Respondents provided information about their most pressing economic and ecological wildlife conflicts; livestock and human pathogens carried by wildlife that are of most concern; research needs related to existing wildlife management tools; new technologies that should be explored; specific program, state or regional wildlife conflicts; and the use of and satisfaction with various NWRC services.

KEY WORDS

National Wildlife Research Center, research, wildlife conflicts, Wildlife Services

INTRODUCTION

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services program (WS) provides Federal leadership and expertise in managing problems caused by wildlife. WS biologists work with a variety of stakeholders to manage a wide range of conflicts, including crop depredations, aviation strike hazards, zoonotic and livestock diseases, degradation of natural habitats, and predation on threatened and endangered species. Management methods and tools vary depending on the species and specific situation, and include non-lethal deterrents, traps , livestock protection dogs, vaccines, chemical repellents, and toxicants.

The National Wildlife Research Center (NWRC, Center) is the research arm of the WS program. The NWRC is headquartered on the Colorado State University foothills campus, with additional staff stationed at eight locations throughout the United States. Center scientists apply scientific expertise to find biologically sound, practical and effective solutions to resolving wildlife damage management issues. Research conducted by NWRC scientists addresses a wide variety of human-wildlife conflicts related to agriculture, property damage, human health and safety, invasive species, natural resources, and endangered and threatened species.

Research priorities at the NWRC are established with guidance from Congress and the WS Deputy Administrator, together with stakeholder input and the results of a research needs assessment (RNA) that is conducted about every 5 years (Packham and Connolly 1992; Bruggers et al. 1996, 2002; Clark et al. 2007; Tobin et al. 2012). Herein we report the results of the most recent RNA, which was conducted in 2016.

METHODS

The WS Deputy Administrator solicited participation in the 2016 RNA from WS Operations and NWRC researchers. Jessica Tegt of the Mississippi State University, Center for Resolving Human-Wildlife Conflicts solicited input from selected external stakeholders. Approximately 250 individuals were surveyed using three different SurveyMonkey questionnaires developed to target the three groups. The WS Operations group included the WS Management Team; WS Assistant Regional Directors and State Directors; the WS National Coordinators of the rabies, feral swine, airport wildlife hazards, and aviation safety national programs; the manager of the WS Pocatello Supply Depot; the two Deputy Directors of the WS Operational Support Staff; and the WS Resource Management Specialist. The NWRC group included the NWRC management team and research grade scientists. External stakeholders included non-WS federal agencies and non-federal stakeholders with an interest in and/or knowledge of human-wildlife conflicts, including livestock, agriculture, forestry, aviation, aquaculture industries; state and local governments; university research and extension personnel; non-government organizations; animal welfare and conservation groups; and the private pest control industry.

Slightly different versions of the survey were distributed via SurveyMonkey to NWRC employees (Appendix III), WS Operations employees (Appendix IV), and external stakeholders (Appendix V). The basic survey consisted of a series of questions asking each respondent to specify his/her affiliation or area of work, position and title; to list areas of wildlife-human conflict of most economic, ecological, or health concern; to identify priority areas for research; and to answer a series of questions about his/her knowledge of and interaction with the NWRC.

Some of the species/species groups and conflict areas listed in the results could have been put in 2 or more groups, and for some, we made a decision about the most appropriate group. For example, we categorized beavers and muskrats as “aquatic mammals,” but placed nutria in the “invasive species” category. Because of the magnitude of their impacts, we placed feral swine in a group by themselves instead of with ungulates or invasive species. We categorized coyotes, wolves, and cougars depredating livestock or game as “large carnivores,” but placed coyotes causing urban/suburban problems in the “urban conflicts” category. Likewise, we placed bears causing depredation or agricultural problems in a group by themselves, but bears causing urban/suburban problems threats in “urban conflicts” category. We categorized rats, ground squirrels, and prairie dogs at “rodents,” but characterized beavers and muskrats as “aquatic mammals” and nutria as “invasive species.”

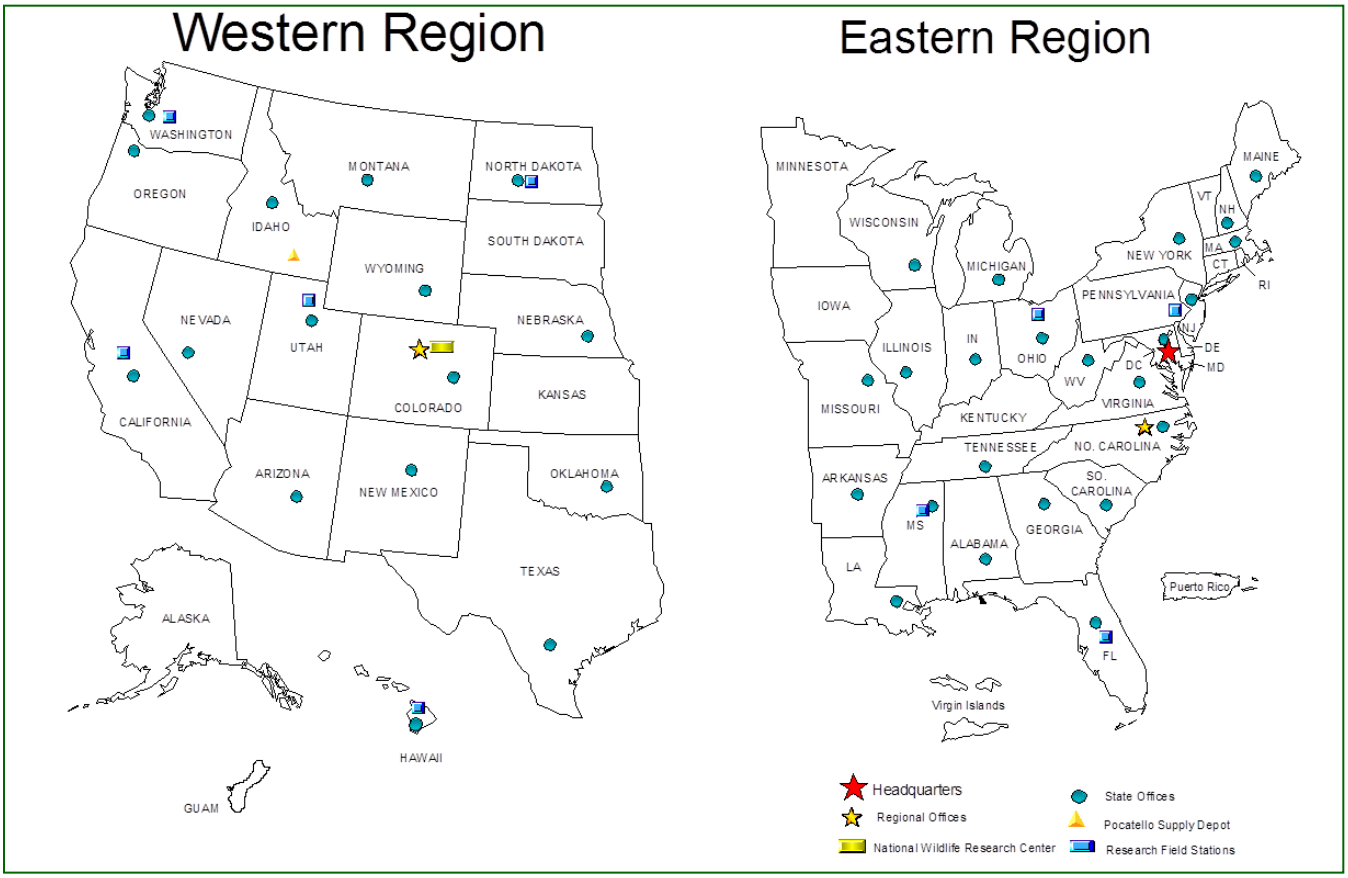
RESPONSES

Fifty-five people (73%) responded to the WS Operations survey, including 26 from the Eastern Region (ER, Figure 1), 20 from the Western Region (WR), and 9 from the WS national level (headquarters, Operational Support Staff, and national programs). Thirty research grade scientists and administrators (83%) responded to the NWRC survey. Forty-six people (32%) responded to the stakeholder survey. External respondents included people from academia (24%), state natural resource agencies (15%), livestock commodity groups (13%), non-profit organizations (11%), agricultural commodity groups (9%), state agricultural agencies (4%), crop commodity groups (2%), human health agencies (2%), and other (20%).

Wildlife conflicts of economic concern

All respondents in the WR, and more than half of respondents at the WS national level and

Figure 1. Eastern and Western Regions of the WS Program.



external stakeholders, cited predation by large carnivores (i.e., coyotes, wolves, cougars, or bears) as among the three most significant economic wildlife issues in their respective program, state or region, compared to only 26% of respondents in the WS ER (Table 1). Feral swine, aviation strike hazards, and aquatic mammals (beavers and muskrats) were also major concerns in the WR. Respondents in the ER were most concerned about aviation strike hazards, aquatic mammals, and feral swine. Respondents in all groups listed a broad spectrum of avian conflicts involving fish-eating birds (3); Canada geese (2); vultures (2); crop damage by starlings (1), blackbirds (2), cedar waxwings (1), and sandhill cranes (1); pigeon damage to structures (2); urban bird damage; aircraft strike hazards (1), and gulls (1). A

Table 1. Species/species groups or wildlife damage issues identified as one of the 3 most significant wildlife economic impacts by percentage of respondents.

Species/Species Group/Damage	Wildlife Services				External Stakeholders (n=34)
	Western Region (n=23)	Eastern Region (n=23)	National Programs (n=9)	NWRC (n=30)	
Predation	100	26	56	20	53
Feral swine	43	43	89	63	32
Birds	26	43	44	93	50
Aviation-wildlife strikes	35	52	22	27	0
Aquatic mammals	30	48	22	7	3
Invasive species	12	0	11	17	9
Ungulates	0	30	22	20	30
Rodents	23	0	0	20	26
Wildlife diseases	6	4	33	37	12
Predation on T&E species	0	0	0	0	6
Raccoons	0	0	0	0	3
Feral cats/dogs	0	0	0	6	3
Bears (agriculture)	0	9	0	3	3

minority of respondents listed various invasive species (brown treesnakes, nutria, axis deer, and mute swans, and invasive species in general) as being a major concern. Wildlife diseases, mostly rabies and bovine tuberculosis (bTB), were major concerns to WS national and NWRC respondents.

Anticipated future wildlife conflicts of economic concern

We also asked respondents to identify wildlife economic conflicts that currently might not be major problems in their state, region or program, but are likely to become so in the next 8-10 years (Table 2). Feral swine were the wildlife issue most frequently listed by respondents in

Table 2. Species/species groups or wildlife damage issues identified as currently not causing significant economic impacts, but anticipated to become more severe in the next 8-10 years by percentage of respondents.

Species/Species Group/Damage	Wildlife Services				External Stakeholders (n=24)
	Western Region (n=21)	Eastern Region (n=21)	National Programs (n=6)	NWRC (n=24)	
Feral swine	62	29	83	29	25
Birds	38	48	17	21	29
Wildlife diseases	19	33	83	92	21
Predation	29	14	17	17	32
Urban conflicts	52	24	0	4	21
Invasive species	9	14	0	33	25
Bears (property, urban, unspecified)	9	24	0	0	8
Ungulates	9	19	0	4	5
Predation on T&E species	14	0	0	0	12
Aquatic mammals	9	5	0	0	0
Rodents	5	5	0	0	0
Feral cats/dogs	0	0	0	8	0

both the WR and WS national, but were also listed by more than a quarter of ER, NWRC and external stakeholders. Various bird conflicts were the number one concern of ER respondents, but were also frequently listed by the other groups. Bird issues mentioned included predation by fish-eating birds (29% of ER respondents, 17% of both WS national respondents and external stakeholders), aviation strike hazards (19% ER), and geese (9% ER, 14% WR). Cranes, turkeys, raptors, corvids, vultures, starlings, and blackbirds were also identified as likely looming economic problems. More than half of WR respondents expressed a concern about future urban wildlife conflicts involving coyotes, deer, geese, bears, or prairie dogs. Various wildlife-transmitted diseases were a top concern of both WS national and NWRC

respondents. Disease issues identified as likely to become more severe included highly pathogenic avian influenza (9% ER, 12% NWRC, 12% external stakeholders), chronic wasting disease (9% ER, 17% WS national, 4% NWRC, 12% external stakeholders), and rabies (9% ER, 19% WR, 50% WS national, 4% NWRC). A number of respondents listed just wildlife diseases in general. Predation on livestock and game species by coyotes, wolves, and cougars were perceived as a growing economic threat by all groups of respondents, especially in the WR and external stakeholders. Urban wildlife conflicts are a growing concern in both the ER and WR, and of external stakeholders. Respondents in the WR and external stakeholders specified coyotes as the main urban threats; ER respondents listed coyotes, bears, and wildlife in general. The invasive species/species groups identified as growing threats included reptiles (ER), fish (ER and WR), nutria (WR), brown treesnakes (WR, NWRC), and monk parakeets (NWRC). Finally, both ER and the WR respondents identified bears and ungulates as likely causing increasingly severe economic conflicts in the next 8-10 years.

Wildlife conflicts of ecological concern

A majority of respondents in all groups rated feral swine as one of the top three wildlife issues of ecological concern (Table 3). Coyote, cougar and bear predation on game species, sage grouse, and endangered black-footed ferrets was a major ecological concern in the WR. Birds also were an ecological issue for all groups, especially the ER. Specific issues included fish-eating birds (33% ER, 10% WR, 10% NWRC, 11% external stakeholders), geese (17% ER), bird-aircraft strikes (27% NWRC), cowbirds (8% ER), and ravens (20% WS national). There was also widespread concern about invasive species and ungulates.

Table 3. Species/species groups or wildlife damage issues identified as one of the 3 most significant wildlife ecological impacts by percentage of respondents.

Species/Species Group/Damage	Wildlife Services				External Stakeholders (n=28)
	Western Region (n=19)	Eastern Region (n=24)	National Programs (n=5)	NWRC (n=29)	
Feral swine	79	75	100	65	54
Birds	10	58	20	28	14
Predation on T&E species	26	42	0	21	29
Invasive species	26	17	40	7	11
Ungulates	0	33	20	28	29
Aquatic mammals	21	33	0	3	11
Predation	47	8	0	0	11
Aviation-wildlife strikes	10	0	0	7	0
Wildlife diseases	10	4	1	3	7
Rodents	5	4	0	3	7
Feral cats/dogs	0	0	0	14	4
Wild horses/burros	0	0	0	0	4

Anticipated wildlife conflicts of future ecological concern

Respondents identified the top 3 conflicts/wildlife damage problems that currently do not cause significant ecological impacts in a particular region or state, but are anticipated to do so in the next 8-10 years (Table 4). Feral swine, wildlife-transmitted diseases, birds, and invasive species were most often predicted to become more severe problems. Chronic wasting disease was the disease most often specified (50% and 58% of ER and WR, respectively, 20% WS national), but highly pathogenic avian influenza (19% ER) and to a lesser degree bovine tuberculosis, rabies, Lyme disease, bat white-nose syndrome, avian malaria, and Brucellosis were also listed as diseases of likely increased ecological importance. Respondents in all groups except external stakeholders identified various avian conflicts as looming ecological

Table 4. Species/species groups or wildlife damage issues identified as currently not causing significant ecological impacts, but anticipated to become more severe in the next 8-10 years by percentage of respondents.

	Wildlife Services				
Species/Species Group/Damage	Western Region (n=19)	Eastern Region (n=16)	National Programs (n=5)	NWRC (n=23)	External Stakeholders (n=17)
Feral swine	58	19	100	26	35
Wildlife diseases	58	87	20	65	94
Birds	26	44	40	26	0
Invasive species	16	37	40	70	53
Large carnivores	10	6	0	13	23
Predation on T&E species	26	6	0	0	12
Feral cats/dogs	0	6	20	9	6
Urban conflicts	0	0	0	17	0
Rodents	10	0	0	0	0
Ungulates	0	6	0	0	0
Armadillos	0	0	0	0	6

challenges. The specific problems cited encompass a range of species and situations: double-crested cormorants (19% ER), American white pelicans (19% and 20% for the ER and WS national, respectively), Canada geese (12% ER), and ravens (16% and 20% in WR and WS national, respectively). Vultures, barn swallows, starlings, and snow geese were also cited as looming ecological concerns. Large carnivore predation on livestock and game species (coyotes in the ER and coyotes and cougars in the WR) were specifically mentioned. Urban conflicts involving coyotes and bears were also predicted to increase. Two respondents listed just urbanization or urban sprawl, without specifying any species or particular problem.

Diseases/Pathogens of concern

A significant proportion of all groups listed rabies, highly pathogenic avian influenza, chronic wasting disease, and swine-vectored diseases (Brucellosis, pseudorabies) as the major wildlife or wildlife-vectored diseases or pathogens impacting livestock or human health (Table 5). Half of all NWRC respondents also identified food-borne pathogens (*E. coli, Salmonella*, antimicrobial resistance) as a significant threat.

Wildlife damage management tools

Respondents in all groups expressed a concern about the loss of various pesticides for managing wildlife conflicts (Table 6). Many respondents listed pesticides in general, without specifying any particular pesticide. DRC-1339 and M-44 were most commonly mentioned as pesticides at risk. Six external stakeholders expressed concern about the potential loss of second generation anticoagulants. Potential bans on trapping and snaring were a concern expressed by all groups, especially the WR and external stakeholders. WR respondents and external stakeholders were also concerned about the potential future bans on aerial gunning operations. Public concerns about animal welfare and increasing regulations were the most frequently cited reasons for the likely future loss of wildlife management tools.

Respondents expressed a need for research to improve the efficacy of a wide variety of tools and methods (Table 7). WS Operations most frequently listed a need for better tools to manage feral swine, coyotes and wolves, and birds. Aerial gunning operations and DRC-1339 were specifically mentioned. Respondents expressed the need for better methods of monitoring traps remotely, better triggering devices, and trap tranquilizer devices. Many of the responses did not specify a particular species or problem, but rather a general need for better toxicants, traps, snares, or other devices or methods.

Table 5. Livestock or human diseases or pathogens identified as one of the top 3 diseases of concern by percentage of respondents.

Disease/Pathogen	Wildlife Services				External Stakeholders (n=14)
	Western Region (n=19)	Eastern Region (n=18)	National Programs (n=5)	NWRC (n=26)	
Viruses					
Rabies	53	44	60	23	37
Avian influenza	42	61	40	50	25
Arboviruses (i.e., Zika, Dengue, West Nile Virus)	0	6	0	15	0
Vesticular stomatitis	0	0	0	4	0
Encephalitis	0	0	0	4	0
Foot and mouth disease	0	0	0	4	0
Hanta virus	0	0	0	0	12
Japanese encephalitis	0	0	0	4	0
Rift Valley Fever	0	0	0	4	0
Prions Chronic Wasting Disease	16	28	60	19	29
Bacteria					
Swine-vectored diseases (i.e., brucellosis, pseudorabies)	42	61	40	11	46
Food-borne pathogens (i.e., E. coli, Salmonella, Antimicrobial resistant)	21	6	0	50	17
Bovine tuberculosis	5	11	0	8	12
Lyme disease	0	11	0	4	0
Plague	5	0	20	8	8
Leptospirosis	10	0	0	0	0
Typhus	0	0	0	0	4
Parasites Digenetic trematodes, liver flukes, tapeworms	0	11	0	0	25
Fungi Histoplasmosis	0	0	0	4	4
Protozoa					
Cattle Tick Fever	0	0	0	4	0
Giardiasis	5	0	0	0	0
Miscellaneous					
Tick/Mosquito-borne diseases	0	11	0	11	0
Vulture-vectored diseases	0	6	0	0	0
Mad cow disease	0	5	0	0	0
Blackbird diseases	0	0	0	4	0
Elk foot rot	0	0	0	0	4

Table 6. Wildlife damage management tools and methods that might become unavailable/unusable in the future by number of respondents.

Tool/Method	Wildlife Services		External Stakeholders
	Operations	NWRC	
Registered Pesticides	21	2	4
DRC-1339	16	1	2
M-44	8	1	-
Compound 1080	2	2	-
Anticoagulants	-	-	6
Alpha chloralose	1	-	-
Wildlife contraceptives	2	1	-
Repellents	-	1	1
Capture Devices			
Traps/Snares	10	3	7
Pole traps	1	1	-
Dogs for treeing animals	1	-	-
Aerial gunning operations	5	1	8
Bird deterrents	2	1	3
Livestock protection dogs	-	-	1
Lead ammunition	2	-	1
Explosives	1	-	-
Night vision/thermal optics	1	-	-

Respondents listed a broad range of technologies and tools that might be useful in conducting wildlife damage management research (Table 8). Twenty-six WS Operations respondents suggested evaluation of unmanned aerial vehicles (UAVs) for various uses, including harassment and damage assessments. Better baits and delivery systems for repellents, toxicants, fertility control agents, pharmaceuticals, and oral vaccines were suggested as promising areas for research. Many respondents suggested adaption of genetic tools for DNA sequencing, detecting environmental DNA (eDNA), analyzing diets, metabolomics-biochemical phenotyping, wildlife forensics, and developing multi-agent recombinant vaccines.

Table 7. Wildlife damage management tools and methods that need improvement by number of respondents.

Tool/Method	Wildlife Services		External Stakeholders
	Operations	NWRC	
Feral swine			
Foot snares	1	-	-
Traps	1	-	-
Baits/lures	1	-	-
Toxicant/Delivery system	1	-	-
Detection	1	-	-
Population estimation	1	-	-
Monitoring crop damage	1	-	-
Better ammunition	1	-	-
Large carnivores			
Toxicants	1	1	-
Livestock protection dogs	1	1	-
M-44s—multiple capsules	1	-	-
Livestock protection in Eastern Region	1	-	-
Aerial gunning operations (FLIR, target acquisition)	2	1	-
Nonlethal	1	1	-
Wolves (traps in grizzly habitat, barriers)	3	-	-
Rabies			
Oral rabies vaccine baits	1	-	-
Bait competition	-	-	1
Birds			
Toxicants/DRC-1339 (replace CU Bird Carrier, pigeons, house sparrows)	7	1	-
Scare devices for blueberries	1	-	-
Repellents (corn seed treatment)	2	-	-
Live traps	-	1	1
Raptors (relocation, Verbail raptor traps)	2	1	-
Vulture (harassment, evaluation of patagial tags)	2	-	-
Scare devices/harassment (flashing lights, inflatable effigies, fish-eating birds)	1	-	-
Replacement for alpha chloralose	-	1	-
Rodents (Loss of 2nd generation anticoagulants, aerial application)	1	-	2
Beaver (more selective traps)	2	1	-
Deer (culling methods)	1	-	-
Mongoose (contraceptives)	1	-	-

Table 7 continued. Wildlife damage management tools and methods that need improvement by number of respondents.

Tool/Method	Wildlife Services		External Stakeholders
	Operations	NWRC	
Nonspecific Needs			
Toxicants	1	1	2
Traps (remote monitor, TTD)	4	3	3
Snares	2	-	-
Baits/Lures	-	1	1
Vaccines	-	1	-
Scare devices	1	1	-
Repellents	1	-	-
Disease surveillance tools	1	1	1
Damage assessment tools	1	-	-
Contraceptives (single-use)	1	2	-
Night vision/Thermal optic tools	1	-	-
Unmanned Aerial Vehicles	-	1	1
Floating scare objects	-	-	1
Genomic identification capabilities	-	1	-
Performance measures for monitoring populations and estimating damage	-	1	-
Lead ammunition	1	-	-
Show benefits of modeling	1	-	-

Table 8. Suggested technologies or tools used in other professions or areas that might be useful in wildlife damage management research.

WS Operations

- Unmanned Aerial Vehicles (UAVs) for harassment/damage assessments – 26
- Genetics: genetic mapping, eDNA, DNA for diet analysis in feral swine
- Remote monitoring devices/remote trip devices – 2
- GIS/Spatial data - 2
- Advanced computer modeling
- Light emitting deterrent devices placed on livestock
- List of grasses for use around airports to deter birds
- Thermal imaging
- Contraceptive for feral swine
- Automated attractants for long-term traps
- Net gunning
- High-powered lasers

WS NWRC

- Genetics: forensics, 16s bacterial rDNA sequencing of microbiome, siRNA, eDNA, genome sequencing of wildlife cell culture and in-vitro methods to replace animal testing (2), metabolomics-biochemical phenotyping
- Baits and delivery systems: sensory tools to enhance repellents and attractants, bird resistant feed, chemical repellents for structures and food crops, qualities of baits and traps, injectable sterilization, species-specific pharmaceuticals
- UAVs
- Deterrents: dancing scarecrows (like those in front of car dealerships), electronic noses, trigger mechanisms based on species-specific sounds
- Modeling: incorporation of behavioral, spatial and population dynamics data; population estimation
- Modification of bioterrorism detection systems for invasive species
- Expansion of Rapid Frequency Identification (RFID) from fisheries to terrestrial and semi-aquatic mammals
- High-tech imagery

External Stakeholders

- UAVs
- Genetics: multi-agent recombinant vaccines, genome sequencing
- Baits and delivery systems: oral vaccines addition of repellents to toxicants to deter birds and land crabs, single-dose oral delivery of chemosterilants, Norbormide
- Human dimensions studies
- Livestock protection dog (breeds from around the world) for use in disease management
- Electronic tags on livestock to learn about response to predator attacks
- Lasers
- Pumping soil cement into levees damaged by burrowing rodents
- Male-only mosquito

Damage assessments and ecological studies

A variety of specific local and program research needs were identified (Table 9). Specific research needs relating to feral swine and predators were most commonly mentioned, but airports, beavers, vultures, deer, rodents, fish-eating birds, and diseases were also listed by multiple respondents. A common theme expressed by respondents was the need for more or

better information about populations to facilitate management or support migratory bird permit requests for species such as feral swine, cormorants, ravens, vultures, and raptors.

WS Operations program, local or regional research needs

When asked to list/describe a maximum of 2 research questions they would like addressed in their program, state, or region, WS Operations respondents listed a wide variety of specific needs (Table 10). These needs typically involved damage assessments for pest species and the effectiveness of control methods; development of better management tools and guidelines; and the assessment of environmental and non-target impacts.

NWRC outreach

NWRC outreach activities encompass a range of outlets, including one-on-one communication, peer-reviewed and popular publications, GovDelivery (a government stakeholder registry and communication system) and email announcements, the WS and NWRC websites, and seminars and webinars (Figure 2). One-on-one communications with WS Operations and NWRC employees and outreach materials (factsheets, press releases, and technical notes) were the most frequently used outreach methods/tools used by all three groups (WS Operations, NWRC, and external stakeholders) to get information about NWRC. An internal quarterly newsletter called the *NWRC Science Update* is widely read by both Operations and and NWRC employees. NWRC respondents avail themselves of peer-reviewed publications and the NWRC website on a regular basis. WS Operations staff access the various NWRC online materials less frequently.

Table 9. Recommended damage assessments and ecological studies.

WS Operations

- Feral swine: movement patterns in southeast; food habits/DNA; spread of diseases on islands; ecosystem recovery time from swine damage, impact on deer populations; damage to crops; management (2)
- Predators: lethal vs nonlethal control of wolves; coyote predation on black-footed ferrets; golden eagle damage to livestock and sage grouse; cost of predation damage management; effectiveness of nonlethal predation damage management techniques
- Population modeling: cormorants, ravens (2), black vultures (5), raptors (2), cattle egrets, feral swine (2)
- Beavers: impacts to salmonids and cold-water ecosystems (3); effectiveness of beaver exclusion devices; management
- Vultures: damage to livestock and property (2)
- DRC-1339: assessment of risks to non-target species (3)
- T&E species: impacts of raven predation; benefits of recovering western snowy plover/other T&E species; impacts of invasive species
- Airports: quantify risks of wildlife hazards; better estimates of collisions; design of retention ponds; better estimate of wildlife collisions
- Bears: damage to timber
- Ungulates: urban deer damage
- Fish-eating birds: wading bird damage to agriculture
- Ecological questions: impacts of habitat fragmentation on wildlife; impacts of oil and gas development on wildlife; hazards of lead ammunition to birds of prey/eagles; monitor northern long-eared bat population
- Rodents: how to control after eradication of brown treesnakes
- Blackbird roost surveys
- Importance of testing rabies vectors

WS NWRC

- Feral swine: diseases on livestock; impacts to natural resources; population abundance monitoring; longitudinal disease; determining detection probability; contact ecology
- Predators: ecological impacts of coyote range expansion; ecological impacts of large-scale sterilization of coyotes and wolves; efficacy of non-lethal predation damage management tools
- Population modeling: population estimates/structure to improve culling strategies for vultures; population and take modeling to support migratory bird permits (2); 3-dimensional animal movements; food webs
- Airports: better use of behavioral principles in managing animal populations at airports; standardize airport wildlife surveys
- Beavers: spatially explicit models to estimate movements and habitat use
- Bird damage to animal agriculture
- Overall impacts of control on native species and ecosystems
- Rodents: ground squirrel/rodent damage to agricultural crops in California; non-target hazards of rodenticides to wildlife
- Fish-eating birds: epidemiological impacts of diseases on aquaculture
- Invasive species: ecological impact of removing invasive predators from islands; ecological environment that promotes spread of invasive species and pathogens
- Ungulates: impacts on natural and agricultural resources; competition with native species
- Practical field methods to estimate damage and monitor populations
- Ecological impacts of free-roaming or feral dogs
- Unmanned aerial vehicles: use as scare devices
- Diseases: contact ecology of raccoons, skunks and wild birds; long-term data collection on wildlife populations and disease; basic surveys of peridomestic wildlife communities on farms
- Impacts of climate change on migrating birds, other species distributions, etc.
- Impacts of oil spills on wildlife

External Stakeholders

- Feral swine (3)
- Predators: cougars, benefits of livestock protection animals and shepherds
- Grizzly bear
- Ungulates: white-tailed deer and forests
- Rodents: invasive tree squirrels, non-target impacts of rodenticides; impact of ground squirrel burrows on levees
- Registration of repellents
- Diseases: prevalence of rabies in raccoons; prevalence of white-nose syndrome; Chronic Wasting Disease
- Ecological questions: impacts of climate change on wildlife
- Adaptability of urban coyotes
- Fish-eating birds: population monitoring of cormorants; impacts of diving ducks on production of aquaculture fingerlings
- Vultures: population monitoring of black vultures

Table 10. Specific research areas that WS Operations personnel would like addressed in their respective programs, states, or regions.

Birds

- Ravens: population status and modeling; DRC-1339 take (2); impact on sage grouse reproduction; movements between livestock and sage grouse leks/nesting areas at different times of year
- Vultures: impact on calving with absentee landowners; sustainable harvest along Appalachian ridge and for Mississippi Flyway states east of Mississippi River; methods to reduce local and regional populations; social dynamics of foraging vultures; assessment of whether lethal control increase sage grouse survival
- Raptors: golden eagle damage to lambs; development of non-lethal control methods; effect of osprey nest relocation on nest success
- Rose-ringed parakeets: removal methods
- Geese: methods to control damage to wheat; determination of whether lethal control should be used more frequently than non-lethal
- Aquaculture: economic impact of wading and water birds on commercial crawfish industry; status of cormorant populations across mid-South
- Aviation: design of ponds on or near airports; effect of age, sex and migratory status on return rates of relocated raptors; effectiveness of bald eagle relocation efforts; assessment of optimum grass height at Missouri and Iowa airports to reduce wildlife use

Feral Swine

- Assessment of damages; improved baits lures and attractants (4); comparison of trap door designs; techniques for estimating populations (3); assessment control techniques; improvement of control methods (2); better management techniques for managing Eurasian strain of feral swine; assessment of swine-vectored disease impacts to freshwater aquifers

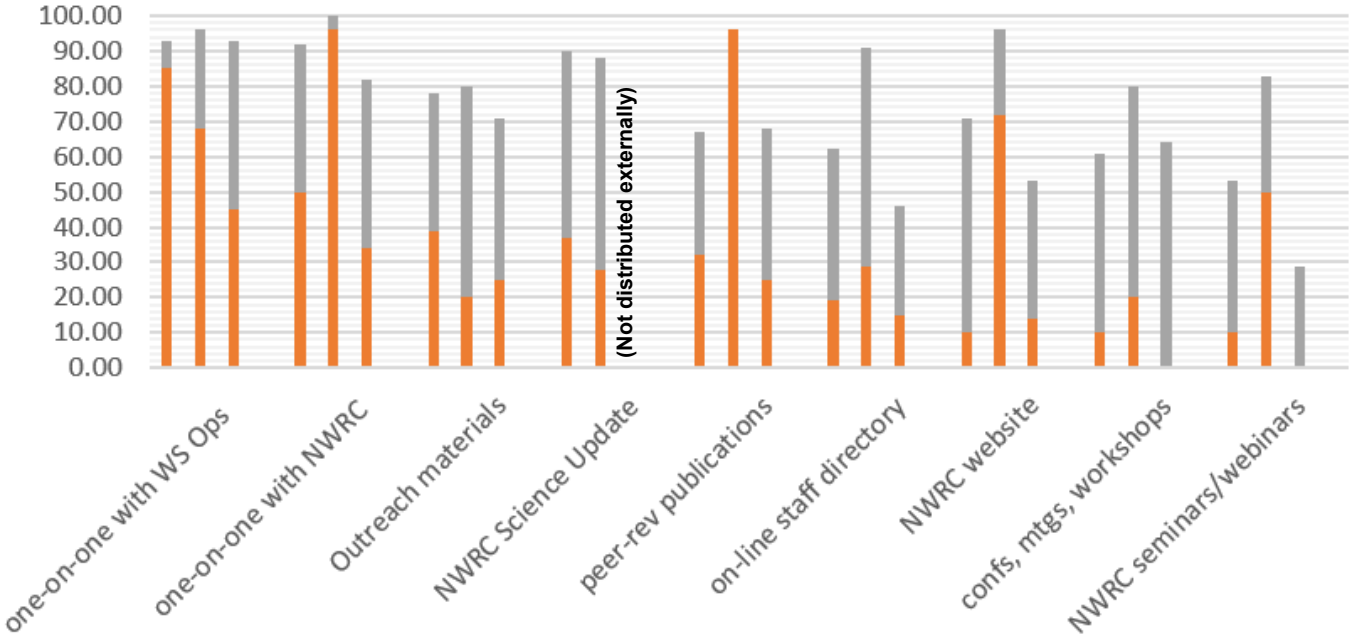
Predators

- Assessment of control methods; cost-effectiveness of wolf fences in upper Midwest; assess M-44 lures; development of non-lethal control methods for eastern U.S.; more lethal control research; economic analysis of WS control activities (2); effectiveness of targeted wolf control; movements and impacts of coyote pairs/family groups; effectiveness of turbofladry; effectiveness of range rider program; assessment of management for enhancing wildlife populations

Other Mammals

- Ungulates: damage reduction relative to different management actions; environmental contamination by lead ammunition; impacts/ damages caused by deer in North Carolina
- Beaver: ecological relationship between river beaver and salmonids; effectiveness of various exclusion devices; effectiveness of beaver fences for excluding damming of water flow devices; efficacy of non-lethal management
- Rodents: more efficient toxicant delivery system for prairie dogs; response to management of brown treesnakes
- Mongooses: better control methods
- Diseases: genetic sequencing of rabies vectors
- National Environmental Policy Act: impacts on target species populations; sustainable predator/prey removals
- Miscellaneous: comparison of lead and non-lead ammunition; development of a viable non-lead bullet for urban deer removal; impact of lead ammunition on raptor populations; environmental lead contamination; impact of management on maintaining functioning ecosystems; analysis of state nuisance wildlife helplines to identify future research needs; analysis of whether population objectives should drive the WS Decision Model

Figure 2. Percentage of WS Operations (left-most stacked bars in each triad), NWRC (the middle bars), and external stakeholders (the stacked bars on the right of each triad) respondents that use various outreach avenues and products monthly (orange) and annually (orange & grey) to obtain information about NWRC.



NWRC support services and outreach

NWRC provides a broad array of support services to Center scientists and WS Operations staff (Table 11). Ninety-one percent of WS Operations and 100% of NWRC respondents said that they use one or more NWRC support services annually. Most of the support services were used by personnel in both the WS Operations and at NWRC. The National Wildlife Disease Program (NWDP) works closely with WS Operations to conduct wildlife disease monitoring and surveillance in all regions of the United States and to act as WS' first responders through NWDP's Surveillance and Emergency Response System. Personnel throughout WS rely on NWRC's library for up-to-date information about a variety of wildlife damage issues. All support units were heavily used by NWRC scientists, especially the archive, quality control/quality assurance, and library units.

Ninety-six percent of WS Operations respondents stated that they had collaborated with at least one NWRC research project during the previous 5 years, and 98% stated that NWRC is

sometimes or always responsive to their research needs. WS Operations respondents had a number of suggestions when asked how NWRC can be more responsive, including be more applied, address WS Operations' needs, give more credit to research that might not result in peer-reviewed publications (e.g., NEPA analyses), conduct more predator damage management research, provide better information on the NWRC website, and publish in a timely fashion. When asked about their preferred venue for receiving information about NWRC research, WS Operations overwhelmingly preferred one-on-one communication (Table 12), although many also read the *NWRC Science Update* and email announcements of publications. NWRC respondents also preferred one-on-one communication, as well as reading peer-reviewed publications. External stakeholders equally preferred one-on-one communication; technical notes, factsheets, brochures, and popular articles; and conferences, meetings, and workshops.

Table 11. Percent of WS Operations and NWRC respondents who used various support services at least annually.

Support Service	Operations	NWRC
National Wildlife Disease Program	95	44
Library	72	86
Safety	71	78
Product Registration	64	59
Technology Transfer	55	63
Archives/Records Management	47	92
Economics	44	37
Genetics	36	61
Geographical Information Systems	34	64
Chemistry/Formulations	34	70
BioLabs	20	47
Modeling	18	19
Animal Care	16	63
Quality Control/Quality Assurance	7	95

Table 12. Number of WS Operations, NWRC and External stakeholder respondents and preferred NWRC outreach activity or product.

Outreach Activity/Product	Wildlife Services		External Stakeholders
	Operations	NWRC	
One-on-one communication	10	10	4
NWRC Science Update newsletter/Email announcements	5	1	-
Peer-reviewed publications	3	8	2
Website, online materials, social media	3	4	2
Technical notes, factsheets, brochures, popular articles	2	4	-
Email	2	3	4
Conferences/Meetings/Workshops	3	-	4
Seminars/Webinars	1	3	-
Monthly Highlights	1	-	-

CONCLUSIONS

The five WS RNA's conducted since 1992 have revealed some markedly similar results in terms of priority wildlife-human conflicts and research needs. Livestock predation, bird depredations on crops and aquaculture, aviation strike hazards, corvid roosts in urban and suburban areas, abundant populations of blackbirds and starlings, aquatic mammals, and invasive species continue to present management challenges. New or increasing challenges include expanding populations of feral swine; new or rapidly expanding wildlife-transmitted zoonotic and livestock diseases such as highly pathogenic avian influenza, rabies, chronic wasting disease, and pseudorabies; urban/suburban wildlife conflicts; and an increasing need to document environmental impacts. Over the years, participants in the WS RNAs have consistently expressed a need for more effective tools (e.g., traps, toxicants, repellents, lures, and vaccines), methods to assess the impact of wildlife damage and management actions, methods to monitor wildlife populations, and more effective non-lethal hazing devices. UAVs, rapidly advancing genetic techniques, geographic information systems (GIS) capabilities, and advanced computer modeling offer new opportunities to facilitate research to develop more

effective tools and management strategies. As human populations and our impacts on the environment continue to grow, existing human-wildlife conflicts will also increase and new conflicts emerge. There is no one tool or method to resolve our wildlife challenges. With the exception of invasive species, most people value and want to preserve wildlife, while reducing their negative impacts. Because of this, we must find a balance in our search for effective, practical and socially acceptable tools and methods to resolve human-wildlife conflicts. Research likely will play an increasingly important role in this search.

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ACKNOWLEDGEMENTS

The authors would like to thank Dr. Jessica Tegt of Mississippi State University's Center for Resolving Human-Wildlife Conflicts for her efforts in soliciting input from selected external stakeholders.

APPENDICES

USDA
United States Department of Agriculture

Animal and Plant Health Inspection Service

Wildlife Services

Office of the Deputy Administrator

1400 Independence Ave SW, Stop 3402
Washington, DC 20250-3402

Tel: 202-799-7095

March 22, 2016

TO: See DISTRIBUTION

FROM: William H. Clay
Deputy Administrator

SUBJECT: Wildlife Services (WS) Research Needs Assessment - 2016

WS research and methods development priorities are established largely through the WS Research Needs Assessment (RNA) process conducted every five years. By this memorandum, I am soliciting your input to the 2016 RNA. Your input should address existing and emerging wildlife damage management issues and research needs in your state, region or program.

The assessment takes approximately 45 minutes to complete. However, I encourage WS State Directors and Program Coordinators in particular to reach out to their staff for feedback regarding the questions posed in the assessment prior to completing it. This ensures a wide variety of wildlife damage issues and topics in your state or program area are considered. A copy of the assessment's questions are attached for your reference.

Once you have received feedback from your staff, please make it a priority to complete the RNA online via the appropriate link below:

For WS Operations Employees – https://www.surveymonkey.com/r/WSOperations

For NWRC Employees – https://www.surveymonkey.com/r/NWRCfeedback

I urge strong participation in this assessment. The survey should be completed by **Friday April 22, 2016**.

As per Office of Management and Budget mandates for research organizations, the NWRC has a research project management system whereby 5 year projects are identified to address WS program and stakeholder research needs. These projects have precise goals, clearly defined objectives, periodic reviews and expected outputs by which research can be initiated and measured. The 2016 RNA is another important step to ensure the WS program's research efforts address high priority and newly identified wildlife issues. Along with Congressional Directives and decisions from the WS Deputy Administrator and the National Wildlife Research Center (NWRC) Director, the RNA helps to determine the NWRC's research focus, hiring priorities, and resource allocation.

DISTRIBUTION
WS Management Team
WS Assistant Regional Directors, State Directors
NWRC Research Grade Scientists
National Coordinator, Rabies Program
National Coordinator, Feral Swine Program
National Coordinator, Airport Wildlife Hazards Program
National Coordinator, Aviation Safety Program
Manager, Pocatello Supply Depot
Operational Support Staff – Steve Kendrot, Alton Dunaway, Michael Marlow

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TO: USDA Wildlife Services Stakeholders

FROM: Dr. Jessica Tegt
Coordinator for Outreach and Continuing Education
Mississippi State University, Center for Resolving Human-Wildlife Conflicts

SUBJECT: Request for Input on 2016 Research Assessment for USDA Wildlife Services

For over ten years, the U.S. Department of Agriculture's (USDA) Wildlife Services and Mississippi State University have partnered to conduct human dimensions research. The Center for Resolving Human-Wildlife Conflicts at Mississippi State is currently administering a survey of research needs related to wildlife damage management. The findings of this survey will help guide research efforts by scientists at the Wildlife Services, National Wildlife Research Center (NWRC).

Because of your expertise and interest in wildlife damage management, we are soliciting your input regarding existing and emerging wildlife damage management issues and research needs in your state, region, and industry.

Your input is important to us. We would appreciate your completing our survey online at: https://www.surveymonkey.com/r/wildlifestakeholders by **Friday, April 22, 2016**. The assessment should take approximately 30 minutes.

The mission of the USDA's Wildlife Services program is to provide Federal leadership and expertise to help resolve human-wildlife conflicts. NWRC, the research arm of Wildlife Services, supports this endeavor through the research and development of wildlife damage management tools, techniques and information. Wildlife Services identifies its research and methods development priorities through a research needs assessment process conducted every five years. This, along with Congressional Directives and decisions from the WS Deputy Administrator and the National Wildlife Research Center (NWRC) Director, helps to determine the NWRC's research focus, hiring priorities, and resource allocation.

Your contribution will help ensure a wide variety of wildlife damage management issues and concerns are identified. Thank you for your assistance.

For questions or concerns, please contact Dr. Jessica Tegt at jessica.tegt@msstate.edu or 662-325-0590.

Regards,

Jessica L. Tegt, Ph.D.
Assistant Extension Professor
Department of Wildlife, Fisheries, and Aquaculture
Mississippi State University

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NWRC Feedback - 2016 WS Research Needs Assessment

Introduction

The mission of USDA-APHIS Wildlife Services (WS) program is to provide Federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist. In support of this mission, the WS National Wildlife Research Center (NWRC) conducts research, explores promising new technologies, develops new tools and techniques, evaluates new and existing methods, conducts economic and risk assessments, and gathers basic ecological information related to wildlife damage management. Its researchers are dedicated to finding biologically sound, practical and effective solutions.

WS conducts a research needs assessment (RNA) every five years to determine the most pressing areas of need for methods evaluations, development, and research. The assessment, along with Congressional Directives and decisions from the WS Deputy Administrator and the NWRC Director, helps to determine NWRC's research focus, hiring priorities, and resource allocation.

We appreciate your taking a few minutes to fill out the following questionnaire. Your feedback will help identify priority wildlife damage management short-and long-term research needs, as well as evaluate the NWRC's current research and support activities, processes, and customer service.

Thank you.

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NWRC Feedback - 2016 WS Research Needs Assessment

Research Needs

The following questions pertain to current and future research needs related to wildlife damage management. This may include methods development, assessments, and outreach. Please note the term "wildlife" below refers primarily to mammals, birds, reptiles, and amphibians.

1. What are the 3 human-wildlife conflicts/wildlife damage problems that cause the most significant economic impacts across the United States and the wildlife species or group of species responsible? Please list in order of most damaging to least damaging.

1 - Economic Damage and Species Responsible

2 - Economic Damage and Species Responsible

3 - Economic Damage and Species Responsible

Example:	
1 – Economic Damage and Species Responsible	Bird-aircraft collisions by a variety of waterfowl species
2 – Economic Damage and Species Responsible	Livestock predation from coyotes
3 – Economic Damage and Species Responsible	Sunflower damage and consumption mainly from blackbirds and European starlings

2. Please provide information on additional species, damages or other details, if appropriate:

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NWRC Feedback - 2016 WS Research Needs Assessment

3. What are the 3 human-wildlife conflicts/wildlife damage problems that cause the most significant ecological impacts across the United States and the wildlife species or group of species responsible? Please list in order of most damaging to least damaging.

1 - Ecological Damage and Species Responsible

2 - Ecological Damage and Species Responsible

3 - Ecological Damage and Species Responsible

Example:	
1 – Ecological Damage and Species Responsible	Damage to riparian habitats from feral swine
2 – Ecological Damage and Species Responsible	Predation on endangered salmon by sea lions
3 – Ecological Damage and Species Responsible	Loss of plant and animal biodiversity on islands due to invasive black rats

4. Please provide information on additional species, damages or other details, if appropriate:

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NWRC Feedback - 2016 WS Research Needs Assessment

5. What human-wildlife conflicts/wildlife damage problems currently do not cause significant economic impacts, but you anticipate they will become more severe in the future (8-10 years)? Please list the top 3 issues in order of most damaging to least damaging.

1 - Future Economic Damage and Species Responsible

2 - Future Economic Damage and Species Responsible

3 - Future Economic Damage and Species Responsible

Example:	
1 – Future Economic Damage and Species Responsible	Damage to agricultural crops due to spread of feral swine
2 – Future Economic Damage and Species Responsible	Conflicts with aggressive urban coyotes
3 – Future Economic Damage and Species Responsible	Use of post-exposure prophylaxis due to rabies in skunks

6. Please provide information on additional species, damages or other details, if appropriate:

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NWRC Feedback - 2016 WS Research Needs Assessment

7. What human-wildlife conflicts/wildlife damage problems currently do not cause significant ecological impacts, but you anticipate they will become more severe in the future (8-10 years)? Please list the top 3 issues in order of most damaging to least damaging.

1 - Future Ecological Damage and Species Responsible

2 - Future Ecological Damage and Species Responsible

3 - Future Ecological Damage and Species Responsible

Example:	
1 – Future Ecological Damage and Species Responsible	Spread of chronic wasting disease in wild ungulates
2 – Future Ecological Damage and Species Responsible	Decreased water quality from feral swine wallowing
3 – Future Ecological Damage and Species Responsible	Raven predation on greater sage grouse and other endangered species

8. Please provide information on additional species, damages or other details, if appropriate:

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9. What livestock or human diseases/pathogens that are harbored or transmitted by wildlife are you most concerned about and why? List up to 3.

1 - Livestock or Human Disease/Pathogen and Reason for Concern

2 - Livestock or Human Disease/Pathogen and Reason for Concern

3 - Livestock or Human Disease/Pathogen and Reason for Concern

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NWRC Feedback - 2016 WS Research Needs Assessment

10. Identify wildlife damage management tools and methods (e.g., aerial gunning, traps, rodenticides or other toxicants, repellents, scare devices, wildlife contraceptives) that you believe might become unavailable/unusable in the future and explain why they may become unavailable/unusable (e.g., new regulations, public concerns, ineffective, costs).

11. Identify wildlife damage management tools and methods that you would like to see improved and how (e.g., less expensive, easier to use, more effective, more target specific, more humane or modified for use with other species).

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12. Are there any technologies or tools used in other professions/areas that you believe might be useful in wildlife damage management research? Please specify.

Examples:
Whole genome sequencing of wildlife species of importance
Modify tuberculosis vaccine for use with wild ungulates
Unmanned aerial vehicles or drones for use in wildlife surveillance

13. In addition to developing and evaluating management tools, NWRC scientists also assess impacts/damage and conduct basic ecological studies in support of wildlife damage management. Please describe any damage assessments and/or ecological studies that may benefit your project or the Wildlife Services program and why.

Examples:
Cormorant population modeling in support of Migratory Bird Take permits
Secondary hazards analysis in support of avicide DRC-1339 registration
Economic damage assessment of feral swine to corn crops in Nebraska; Information will assist with National Environmental Policy Act requirements

14. How often do you use the following to obtain information generated by or about NWRC?

	At least monthly	At least yearly	Every few years	Never	Unaware of this item or activity
Conferences, meetings and workshops	○	○	○	○	○
NWRC seminars and webinars	○	○	○	○	○
NWRC Science Update newsletter	○	○	○	○	○
NWRC staff directory (online)	○	○	○	○	○
NWRC website	○	○	○	○	○
One-on-one communication with NWRC employees	○	○	○	○	○
One-on-one communication with Wildlife Services Operations employees	○	○	○	○	○
Outreach materials, such as factsheets, press releases, stakeholder announcements and tech notes	○	○	○	○	○
Peer-reviewed publications	○	○	○	○	○
USDA GovDelivery/email announcements	○	○	○	○	○

Other (please specify what and how often)

15. Please list/describe your preferred outreach activities or products, including those that may not be listed above:

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NWRC Feedback - 2016 WS Research Needs Assessment

NWRC Research and Support Services

The following questions pertain to the NWRC's current research activities and support services.

16. Has your project collaborated with other NWRC scientists on studies and/or assessments during the past 5 years?

- ◯ Yes - My project has collaborated with other NWRC scientists.
- ◯ No - My project has not collaborated with other NWRC scientists.

17. How often do you request/seek information on other NWRC research activities and results?

- ◯ Monthly or more often
- ◯ Every few months
- ◯ Once a year
- ◯ Once every few years
- ◯ Never

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NWRC Feedback - 2016 WS Research Needs Assessment

18. Has your project used NWRC's support services?

- ◯ Yes
- ◯ No - My project has never worked with NWRC's support services.

If you answered No, please explain why (e.g., unaware of NWRC's support services, no need, lack of funding). Then proceed to question 23.

19. If you answered Yes above, which of the following NWRC support services have you or your project used and how often?

	Monthly	Every few months	Once a year	Once every few years	Never
Animal Care	○	○	○	○	○
Archives/Records Management	○	○	○	○	○
BioLabs	○	○	○	○	○
Chemistry/Formulations	○	○	○	○	○
Economics*	○	○	○	○	○
Genetics*	○	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○	○
Library Services	○	○	○	○	○
Modeling*	○	○	○	○	○
National Wildlife Disease Program	○	○	○	○	○
Product Registration	○	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○	○
Safety	○	○	○	○	○
Technology Transfer	○	○	○	○	○

Please specify any other services and how often:

* Note: These are primarily research groups, but maintain a small support services function for WS Operations and other partners.

20. If you answered Yes above, how would you rate each support services' response to your requests?

	Excellent	Good	Average	Poor	Not Applicable
Animal Care	○	○	○	○	○
Archives/Records Management	○	○	○	○	○
BioLabs	○	○	○	○	○
Chemistry/Formulations	○	○	○	○	○
Economics	○	○	○	○	○
Genetics	○	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○	○
Library Services	○	○	○	○	○
Modeling	○	○	○	○	○
National Wildlife Disease Program	○	○	○	○	○
Product Registration	○	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○	○
Safety	○	○	○	○	○
Technology Transfer	○	○	○	○	○

Other (please specify):

21. If you answered Yes above, how would you rate each support services' timeliness in their response to your requests?

	Excellent	Good	Average	Poor	Not Applicable
Animal Care	○	○	○	○	○
Archives/Records Management	○	○	○	○	○
BioLabs	○	○	○	○	○
Chemistry/Formulations	○	○	○	○	○
Economics	○	○	○	○	○
Genetics	○	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○	○
Library Services	○	○	○	○	○
Modeling	○	○	○	○	○
National Wildlife Disease Program	○	○	○	○	○
Product Registration	○	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○	○
Safety	○	○	○	○	○
Technology Transfer	○	○	○	○	○

Other (please specify):

22. If you answered Yes above, how would you rate the NWRC's costs/fees for support services provided?

	More expensive than comparable service organizations	Similar to comparable service organizations	Less expensive than comparable service organizations	Not Applicable
Animal Care	○	○	○	○
Archives/Records Management	○	○	○	○
BioLabs	○	○	○	○
Chemistry/Formulations	○	○	○	○
Economics	○	○	○	○
Genetics	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○
Library Services	○	○	○	○
Modeling	○	○	○	○
National Wildlife Disease Program	○	○	○	○
Product Registration	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○
Safety	○	○	○	○
Technology Transfer	○	○	○	○

Other (please specify):

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NWRC Feedback - 2016 WS Research Needs Assessment

23. In the next few years, do you anticipate needing assistance from NWRC's support services?

- ◯ Yes
- ◯ No
- ◯ Maybe

If Yes, what type of support services do you anticipate needing?

24. In addition to the support services listed under Question 19 above, please note any other services/expertise you would like to see made available through the NWRC.

25. Please provide any other comments or recommendations for improving the NWRC's support services.

Thank you for sharing your feedback with us.

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WS Operations Feedback - 2016 WS Research Needs Assessment

Introduction

The mission of USDA-APHIS Wildlife Services (WS) program is to provide Federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist. In support of this mission, the WS National Wildlife Research Center (NWRC) conducts research, explores promising new technologies, develops new tools and techniques, evaluates new and existing methods, conducts economic and risk assessments, and gathers basic ecological information related to wildlife damage management. Its researchers are dedicated to finding biologically sound, practical and effective solutions.

WS conducts a research needs assessment (RNA) every five years to determine the most pressing areas of need for methods evaluations, development, and research. The assessment, along with Congressional Directives and decisions from the WS Deputy Administrator and the NWRC Director, helps to determine NWRC's research focus, hiring priorities, and resource allocation.

We appreciate your taking a few minutes to fill out the following questionnaire. Your feedback will help identify priority wildlife damage management short-and long-term research needs, as well as evaluate the NWRC's current research and support activities, processes, and customer service.

Thank you.

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WS Operations Feedback - 2016 WS Research Needs Assessment

1. List your program, state, region or territory:

2. List your position or title:

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WS Operations Feedback - 2016 WS Research Needs Assessment

Research Needs

The following questions pertain to your program's current and future research needs related to wildlife damage management. This may include methods development, assessments, and outreach. Please note the term "wildlife" below refers primarily to mammals, birds, reptiles, and amphibians.

3. What are the 3 human-wildlife conflicts/wildlife damage problems that cause the most significant economic impacts in your program/state/region and the wildlife species or group of species responsible? Please list in order of most damaging to least damaging.

1 - Economic Damage and Species Responsible

2 - Economic Damage and Species Responsible

3 - Economic Damage and Species Responsible

Example:	
1 – Economic Damage and Species Responsible	Bird-aircraft collisions by a variety of waterfowl species
2 – Economic Damage and Species Responsible	Livestock predation from coyotes
3 – Economic Damage and Species Responsible	Sunflower damage and consumption mainly from blackbirds and European starlings

4. Please provide information on additional species, damages or other details, if appropriate:

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WS Operations Feedback - 2016 WS Research Needs Assessment

5. What are the 3 human-wildlife conflicts/wildlife damage problems that cause the most significant ecological impacts in your program/state/region and the wildlife species or group of species responsible? Please list in order of most damaging to least damaging.

1 - Ecological Damage and Species Responsible

2 - Ecological Damage and Species Responsible

3 - Ecological Damage and Species Responsible

Example:	
1 – Ecological Damage and Species Responsible	Damage to riparian habitats from feral swine
2 – Ecological Damage and Species Responsible	Predation on endangered salmon by sea lions
3 – Ecological Damage and Species Responsible	Loss of plant and animal biodiversity on islands due to invasive black rats

6. Please provide information on additional species, damages or other details, if appropriate:

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WS Operations Feedback - 2016 WS Research Needs Assessment

7. What human-wildlife conflicts/wildlife damage problems currently do not cause significant economic impacts in your program/state/region, but you anticipate they will become more severe in the future (8-10 years)? Please list the top 3 issues in order of most damaging to least damaging.

1 - Future Economic Damage and Species Responsible

2 - Future Economic Damage and Species Responsible

3 - Future Economic Damage and Species Responsible

Example:	
1 – Future Economic Damage and Species Responsible	Damage to agricultural crops due to spread of feral swine
2 – Future Economic Damage and Species Responsible	Conflicts with aggressive urban coyotes
3 – Future Economic Damage and Species Responsible	Use of post-exposure prophylaxis due to rabies in skunks

8. Please provide information on additional species, damages or other details, if appropriate:

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9. What human-wildlife conflicts/wildlife damage problems currently do not cause significant ecological impacts in your program/state/region, but you anticipate they will become more severe in the future (8-10 years)? Please list the top 3 issues in order of most damaging to least damaging.

1 - Future Ecological Damage and Species Responsible

2 - Future Ecological Damage and Species Responsible

3 - Future Ecological Damage and Species Responsible

Example:	
1 – Future Ecological Damage and Species Responsible	Spread of chronic wasting disease in wild ungulates
2 – Future Ecological Damage and Species Responsible	Decreased water quality from feral swine wallowing
3 – Future Ecological Damage and Species Responsible	Raven predation on greater sage grouse and other endangered species

10. Please provide information on additional species, damages or other details, if appropriate:

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11. What livestock or human diseases/pathogens that are harbored or transmitted by wildlife are you most concerned about and why? List up to 3.

1 - Livestock or Human Disease/Pathogen and Reason for Concern

2 - Livestock or Human Disease/Pathogen and Reason for Concern

3 - Livestock or Human Disease/Pathogen and Reason for Concern

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12. Identify wildlife damage management tools and methods (e.g., aerial gunning, traps, rodenticides or other toxicants, repellents, scare devices, wildlife contraceptives) that you believe might become unavailable/unusable in the future and explain why they may become unavailable/unusable (e.g., new regulations, public concerns, ineffective, costs).

13. Identify wildlife damage management tools and methods that you would like to see improved and how (e.g., less expensive, easier to use, more effective, more target specific, more humane or modified for use with other species).

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14. Are there any technologies or tools used in other professions/areas that you believe might be useful in wildlife damage management research? Please specify.

Examples:
Whole genome sequencing of wildlife species of importance
Modify tuberculosis vaccine for use with wild ungulates
Unmanned aerial vehicles or drones for use in wildlife surveillance

15. In addition to developing and evaluating management tools, NWRC scientists also assess impacts/damage and conduct basic ecological studies in support of wildlife damage management. Please describe any damage assessments and/or ecological studies that may benefit your program/state/region and why.

Examples:
Cormorant population modeling in support of Migratory Bird Take permits
Secondary hazards analysis in support of avicide DRC-1339 registration
Economic damage assessment of feral swine to corn crops in Nebraska; Information will assist with National Environmental Policy Act requirements

16. Please list/describe a maximum of two research questions you would like addressed in your program/state/region.

17. How often do you use the following to obtain information generated by or about NWRC?

	At least monthly	At least yearly	Every few years	Never	Unaware of this item or activity
Conferences, meetings and workshops	○	○	○	○	○
NWRC seminars and webinars	○	○	○	○	○
NWRC Science Update newsletter	○	○	○	○	○
NWRC staff directory (online)	○	○	○	○	○
NWRC website	○	○	○	○	○
One-on-one communication with NWRC employees	○	○	○	○	○
One-on-one communication with Wildlife Services Operations employees	○	○	○	○	○
Outreach materials, such as factsheets, press releases, stakeholder announcements and tech notes	○	○	○	○	○
Peer-reviewed publications	○	○	○	○	○
USDA GovDelivery/email announcements	○	○	○	○	○

Other (please specify what and how often)

18. Please list/describe your preferred outreach activities or products, including those that may not be listed above:

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NWRC Research and Support Services

The following questions pertain to the NWRC's current research activities and support services.

19. Has your program/state/region collaborated with NWRC scientists on studies and/or assessments during the past 5 years?

- ◯ Yes - My program/state/region has collaborated with NWRC scientists.
- ◯ No - My program/state/region has not collaborated with NWRC scientists.

20. If you answered Yes above, please note which research projects you have collaborated with and how well they met your expectations.

	Exceeded expectations	Met expectations	Did not meet expectations	Not Applicable
Aquaculture (Fred Cunningham, MS)	◯	◯	◯	◯
Aviation Hazards (Travis DeVault, OH)	◯	◯	◯	◯
Blackbirds and Starlings (Page Klug, ND)	◯	◯	◯	◯
Chemistry (Bruce Kimball, CO/PA)	◯	◯	◯	◯
Economics (Stephanie Shwiff, CO)	◯	◯	◯	◯
Emerging Diseases and Food Safety (Alan Franklin, CO)	◯	◯	◯	◯
Feral Swine (Kurt VerCauteren, CO)	◯	◯	◯	◯
Forestry and Aquatic Mammals (Jimmy Taylor, OR)	◯	◯	◯	◯
Genetics (Toni Piaggio, CO)	◯	◯	◯	◯

	Exceeded expectations	Met expectations	Did not meet expectations	Not Applicable
Invasive Species on Islands (Shane Siers, HI)	○	○	○	○
Predator Management (Julie Young, UT)	○	○	○	○
Rabies (Amy Gilbert, CO)	○	○	○	○
Repellents (Scott Werner, CO)	○	○	○	○
Reproductive Technologies/Contraceptives (Doug Eckery, CO)	○	○	○	○
Rodent Management (Gary Witmer, CO)	○	○	○	○
Ungulate Disease and Damage (Kurt VerCauteren, CO)	○	○	○	○
Vultures and Invasive Species (Michael Avery, FL)	○	○	○	○

Please explain, if your expectations were not fully met:

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21. Is NWRC responsive to your research needs?

- ◯ Yes
- ◯ No
- ◯ Sometimes

Please explain how NWRC can be more responsive:

22. What is your primary way of communicating with NWRC and/or making a research request?

- ◯ One-on-one communication with an NWRC researcher
- ◯ One-on-one communication with the NWRC Directors Office
- ◯ Other (please specify)

23. How often do you request/seek information on NWRC research activities and results?

- ◯ Monthly or more often
- ◯ Every few months
- ◯ Once a year
- ◯ Once every few years
- ◯ Never

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24. Has your program used NWRC's support services?

- ◯ Yes
- ◯ No - My program/state/region has never worked with NWRC's support services.

If you answered No, please explain why (e.g., unaware of NWRC's support services, no need, lack of funding). Then proceed to question 29.

25. If you answered Yes above, which of the following NWRC support services have you or your program used and how often?

	Monthly	Every few months	Once a year	Once every few years	Never
Animal Care	○	○	○	○	○
Archives/Records Management	○	○	○	○	○
BioLabs	○	○	○	○	○
Chemistry/Formulations	○	○	○	○	○
Economics*	○	○	○	○	○
Genetics*	○	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○	○
Library Services	○	○	○	○	○
Modeling*	○	○	○	○	○
National Wildlife Disease Program	○	○	○	○	○
Product Registration	○	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○	○
Safety	○	○	○	○	○
Technology Transfer	○	○	○	○	○

Please specify any other services and how often:

* Note: These are primarily research groups, but maintain a small support services function for WS operations and other partners.

26. If you answered Yes above, how would you rate each support services' response to your requests?

	Excellent	Good	Average	Poor	Not Applicable
Animal Care	○	○	○	○	○
Archives/Records Management	○	○	○	○	○
BioLabs	○	○	○	○	○
Chemistry/Formulations	○	○	○	○	○
Economics	○	○	○	○	○
Genetics	○	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○	○
Library Services	○	○	○	○	○
Modeling	○	○	○	○	○
National Wildlife Disease Program	○	○	○	○	○
Product Registration	○	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○	○
Safety	○	○	○	○	○
Technology Transfer	○	○	○	○	○

Other (please specify):

27. If you answered Yes above, how would you rate each support services' timeliness in their response to your requests?

	Excellent	Good	Average	Poor	Not Applicable
Animal Care	○	○	○	○	○
Archives/Records Management	○	○	○	○	○
BioLabs	○	○	○	○	○
Chemistry/Formulations	○	○	○	○	○
Economics	○	○	○	○	○
Genetics	○	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○	○
Library Services	○	○	○	○	○
Modeling	○	○	○	○	○
National Wildlife Disease Program	○	○	○	○	○
Product Registration	○	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○	○
Safety	○	○	○	○	○
Technology Transfer	○	○	○	○	○

Other (please specify):

28. If you answered Yes above, how would you rate the NWRC's costs/fees for support services provided?

	More expensive than comparable service organizations	Similar to comparable service organizations	Less expensive than comparable service organizations	Not Applicable
Animal Care	○	○	○	○
Archives/Records Management	○	○	○	○
BioLabs	○	○	○	○
Chemistry/Formulations	○	○	○	○
Economics	○	○	○	○
Genetics	○	○	○	○
Geographic Information Systems (GIS)	○	○	○	○
Library Services	○	○	○	○
Modeling	○	○	○	○
National Wildlife Disease Program	○	○	○	○
Product Registration	○	○	○	○
Quality Control/Quality Assurance	○	○	○	○
Safety	○	○	○	○
Technology Transfer	○	○	○	○

Other (please specify):

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WS Operations Feedback - 2016 WS Research Needs Assessment

29. In the next few years, do you anticipate needing assistance from NWRC's support services?

- ◯ Yes
- ◯ No
- ◯ Maybe

If Yes, what type of support services do you anticipate needing?

30. In addition to the support services listed under Question 25 above, please note any other services/expertise you would like to see made available through the NWRC.

31. Please provide any other comments or recommendations for improving the NWRC's support services.

Thank you for sharing your feedback with us.

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CENTER FOR RESOLVING HUMAN/WILDLIFE CONFLICTS

Wildlife Damage Management - Stakeholder Questionnaire

Introduction

Every 5 years, the U.S. Department of Agriculture's (USDA) Wildlife Services program conducts a research needs assessment (RNA) to help ensure the program's research efforts address high priority and newly identified wildlife issues. This year, Wildlife Services (WS) is partnering with Mississippi State University's Center for Resolving Human-Wildlife Conflicts to gather feedback from a variety of professionals with expertise and interest in wildlife damage management. Your input and time in this important endeavor is very much appreciated. Your responses, along with Congressional Directives, help to determine WS' research focus, hiring priorities, and resource allocation.

The mission of USDA's WS program is to provide Federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist. In support of this mission, the WS National Wildlife Research Center (NWRC) conducts research, explores promising new technologies, develops new tools and techniques, evaluates new and existing methods, conducts economic and risk assessments, and gathers basic ecological information related to wildlife damage management. Its researchers are dedicated to finding biologically sound, practical, and effective solutions.

Thank you for your participation.

Jessica Tegt, Ph.D.
Assistant Extension Professor
Department of Wildlife, Fisheries, and Aquaculture
Mississippi State University

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Wildlife Damage Management - Stakeholder Questionnaire

1. Which of the following best describes who you work for?

- ◯ Academia
- ◯ Agricultural agency
- ◯ Industry/Commodity group - Aquaculture
- ◯ Industry/Commodity group - Aviation
- ◯ Industry/Commodity group - Crops
- ◯ Industry/Commodity group - Forestry
- ◯ Industry/Commodity group - Livestock
- ◯ Infectious diseases or Human health agency
- ◯ Non-profit organization
- ◯ Natural resources agency
- ◯ USDA-APHIS Veterinary Services or other APHIS program
- ◯ Other (please specify)

2. List your program, state, region or territory:

3. List your position or title:

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Wildlife Damage Management - Stakeholder Questionnaire

The following questions pertain to your program's current and future research needs related to wildlife damage management. This may include methods development, assessments, and outreach. Please note the term "wildlife" below refers primarily to mammals, birds, reptiles, and amphibians.

4. How often do you deal with wildlife damage management issues?

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Several times a year
- ◯ Other (please specify)

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Wildlife Damage Management - Stakeholder Questionnaire

5. What are the 3 human-wildlife conflicts/wildlife damage problems that cause the most significant economic impacts in your program/state/region and the wildlife species or group of species responsible? Please list in order of most damaging to least damaging.

1 - Economic Damage and Species Responsible

2 - Economic Damage and Species Responsible

3 - Economic Damage and Species Responsible

Example:	
1 – Economic Damage and Species Responsible	Bird-aircraft collisions by a variety of waterfowl species
2 – Economic Damage and Species Responsible	Livestock predation from coyotes
3 – Economic Damage and Species Responsible	Sunflower damage and consumption mainly from blackbirds and European starlings

6. Please provide information on additional species, damages or other details, if appropriate:

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Wildlife Damage Management - Stakeholder Questionnaire

7. What are the 3 human-wildlife conflicts/wildlife damage problems that cause the most significant ecological impacts in your program/state/region and the wildlife species or group of species responsible? Please list in order of most damaging to least damaging.

1 - Ecological Damage and Species Responsible

2 - Ecological Damage and Species Responsible

3 - Ecological Damage and Species Responsible

Example:	
1 – Ecological Damage and Species Responsible	Damage to riparian habitats from feral swine
2 – Ecological Damage and Species Responsible	Predation on endangered salmon by sea lions
3 – Ecological Damage and Species Responsible	Loss of plant and animal biodiversity on islands due to invasive black rats

8. Please provide information on additional species, damages or other details, if appropriate:

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Wildlife Damage Management - Stakeholder Questionnaire

9. What human-wildlife conflicts/wildlife damage problems currently do not cause significant economic impacts, but you anticipate they will become more severe in the future (8-10 years)? Please list the top 3 issues in order of most damaging to least damaging.

1 - Future Economic Damage and Species Responsible

2 - Future Economic Damage and Species Responsible

3 - Future Economic Damage and Species Responsible

Example:	
1 – Future Economic Damage and Species Responsible	Damage to agricultural crops due to spread of feral swine
2 – Future Economic Damage and Species Responsible	Conflicts with aggressive urban coyotes
3 – Future Economic Damage and Species Responsible	Use of post-exposure prophylaxis due to rabies in skunks

10. Please provide information on additional species, damages or other details, if appropriate:

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Wildlife Damage Management - Stakeholder Questionnaire

11. What human-wildlife conflicts/wildlife damage problems currently do not cause significant ecological impacts, but you anticipate they will become more severe in the future (8-10 years)? Please list the top 3 issues in order of most damaging to least damaging.

1 - Future Ecological Damage and Species Responsible

2 - Future Ecological Damage and Species Responsible

3 - Future Ecological Damage and Species Responsible

Example:	
1 – Future Ecological Damage and Species Responsible	Spread of chronic wasting disease in wild ungulates
2 – Future Ecological Damage and Species Responsible	Decreased water quality from feral swine wallowing
3 – Future Ecological Damage and Species Responsible	Raven predation on greater sage grouse and other endangered species

12. Please provide information on additional species, damages or other details, if appropriate:

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Wildlife Damage Management - Stakeholder Questionnaire

13. What livestock or human diseases/pathogens that are harbored or transmitted by wildlife are you most concerned about and why? List up to 3.

1 - Livestock or Human Disease/Pathogen and Reason for Concern

2 - Livestock or Human Disease/Pathogen and Reason for Concern

3 - Livestock or Human Disease/Pathogen and Reason for Concern

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Wildlife Damage Management - Stakeholder Questionnaire

14. Identify wildlife damage management tools and methods (e.g., aerial gunning, traps, rodenticides or other toxicants, repellents, scare devices, wildlife contraceptives) that you believe might become unavailable/unusable in the future and explain why they may become unavailable/unusable (e.g., new regulations, public concerns, ineffective, costs).

15. Identify wildlife damage management tools and methods that you would like to see improved and how (e.g., less expensive, easier to use, more effective, more target specific, more humane or modified for use with other species).

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Wildlife Damage Management - Stakeholder Questionnaire

16. Are there any technologies or tools used in other professions/areas that you believe might be useful in conducting wildlife damage management research? Please specify.

Examples:
Whole genome sequencing of wildlife species of importance
Modify tuberculosis vaccine for use with wild ungulates
Unmanned aerial vehicles or drones for use in wildlife surveillance

17. In addition to developing and evaluating management tools, Wildlife Services' National Wildlife Research Center scientists also assess impacts/damage and conduct basic ecological studies in support of wildlife damage management. Please describe any damage assessments and/or ecological studies that may benefit your program/state/region and why.

Examples:
Cormorant population modeling in support of Migratory Bird Take permits
Secondary hazards analysis in support of avicide DRC-1339 registration
Economic damage assessment of feral swine to corn crops in Nebraska; Information will assist with National Environmental Policy Act requirements

MISSISSIPPI STATE UNIVERSITY
CENTER FOR RESOLVING HUMAN/WILDLIFE CONFLICTS

Wildlife Damage Management - Stakeholder Questionnaire

18. How often do you use the following to obtain information generated by or about Wildlife Services' National Wildlife Research Center (NWRC)?

	At least monthly	At least yearly	Every few years	Never	Unaware of this item or activity
Conferences, meetings and workshops	○	○	○	○	○
NWRC seminars and webinars	○	○	○	○	○
NWRC staff directory (online)	○	○	○	○	○
NWRC website	○	○	○	○	○
One-on-one communication with NWRC employees	○	○	○	○	○
One-on-one communication with Wildlife Services Operations employees	○	○	○	○	○
Outreach materials, such as factsheets, press releases, stakeholder announcements and tech notes	○	○	○	○	○
Peer-reviewed publications	○	○	○	○	○
USDA GovDelivery/email announcements	○	○	○	○	○

Other (please specify what and how often)

19. Please list/describe your preferred outreach activities or products, including those that may not be listed above:

20. Please provide any other comments or recommendations for how the Wildlife Services National Wildlife Research Center can help you in your job:

Thank you for sharing your feedback with us.

World cloud highlighting wildlife species or issues likely to have the most significant future economic impacts based on survey responses from WS Operations employees. Word clouds are graphical representations of word frequency that give greater prominence to words that appear more frequently in a source text. The larger the word in the visual, the more often the word was mentioned in responses to the 2106 WS Research Needs Assessment.

For more information, please contact:

USDA-APHIS-Wildlife Services

National Wildlife Research Center

4101 LaPorte Avenue

Fort Collins, CO 80521

970-266-6000