The impacts of dogs on wildlife and water quality: A literature review

Compiled by Lori Hennings, Metro Parks and Nature, April 2016

SUMMARY

Metro periodically reviews the science literature behind its natural resource policies to ensure policies are based on the most current science. Recently staff reviewed the scientific literature regarding the impacts of dogs on wildlife to inform Metro Regulatory Code Title 10.01, which excludes pets from most Metro properties. The only exceptions are service dogs, leashed dogs on some regional trails, Broughton Beach, boat ramps and properties managed by others through intergovernmental agreements that are integrated into larger parks where leashed dogs are allowed (e.g., Forest Park).

Any human related activity can disturb wildlife. In order to meet Metro's dual goals of protecting natural resources and providing access to nature, Metro has tried to strategically locate trails in less sensitive habitat and to ensure that human activity is as non-disruptive as possible. Part of that strategy has been to allow public access, while limiting certain activities such as bringing dogs into natural areas.

The evidence that dogs negatively impact wildlife is overwhelming. It is clear that people with dogs – on leash or off – are much more detrimental to wildlife than people without dogs. Dogs (*Canis lupus familiaris*) are considered to be a subspecies of wolves (*Canis lupus*), and wildlife perceive dogs as predators.[30] Impacts include:

1. **Physical and temporal displacement** – The presence of dogs causes wildlife to move away, temporarily or permanently reducing the amount of available habitat in which to feed, breed and rest. Animals become less active during the day to avoid dog interactions. Furthermore, the scent of dogs repels wildlife and the effects remain after the dogs are gone.
2. **Disturbance and stress response** – Animals are alarmed and cease their routine activities. This increases the amount of energy they use, while simultaneously reducing their opportunities to feed. Repeated stress causes long-term impacts on wildlife including reduced reproduction and growth, suppressed immune system and increased vulnerability to disease and parasites.
3. **Indirect and direct mortality** – Dogs transmit diseases (such as canine distemper and rabies) to and from wildlife. Loose dogs kill wildlife.
4. **Human disease and water quality impacts** - Dog waste pollutes water and transmits harmful parasites and diseases to people.

INTRODUCTION

Metro owns 17,000 acres of parks and natural areas and does not allow dogs or other pets on the vast majority of these lands. Exceptions include service animals, leashed dogs on some regional trails, Broughton Beach, boat ramps and certain properties managed by others through intergovernmental

agreements that are integrated into larger parks where leashed dogs are allowed (e.g., Forest Park). The policy that prohibits visitors from bringing pets to most of Metro's managed parks and natural areas was initiated by Multnomah County in the 1980s and continued in practice after Metro assumed management of those parks in the early 1990s. After a review of the scientific literature and meaningful public discourse, Metro formally adopted the pets policy into its code in 1997 (Metro Council Regulatory code Title 10.01 adopted in Ordinance 96-659A).

To ensure this decision reflects the most up-to-date information, Metro staff examined 54 peer-reviewed scientific journal articles and several research reports relating to the impacts of dogs in natural areas, including numerous literature reviews on the impacts of various types of recreation on wildlife and habitat.[10, 28, 42,54,61,63, 65,68,71,73,77] The results of our literature review are summarized below.

PHYSICAL AND TEMPORAL DISPLACEMENT

Displacement may be the most significant impact due to the amount of habitat affected. The presence of dogs causes most wildlife to move away from an area, which temporarily or permanently reduces the amount of functionally available habitat to wildlife. The research is clear that people with dogs disturb wildlife more than humans alone.[5,10,33,38,39,41,44,61,68,69] These effects reduce a natural area's carrying capacity for wildlife, and also reduces wildlife viewing experiences for visitors.

Studies on a variety of wildlife in many countries and settings demonstrate that dogs along trails and in natural areas significantly alter wildlife behavior.[9,33,39,41,49,53,58] A 2011 literature review found negative dog effects in all 11 papers that examined such effects.[65] Studies demonstrate dog-specific impacts on reptiles,[29,31,48] shorebirds and waterfowl,[24,32,51,69] songbirds,[5,9,10] small mammals,[33,39,56] deer, elk and bighorn sheep,[4,36,38,44,49,59,63] and carnivores.[22,33,52,58]

A study in France found that two hikers disturbed an area of 3.7 hectares walking near wild sheep, whereas two hikers with dogs disturbed 7.5 hectares around the sheep.[41] In Chicago, migratory songbirds were less abundant in yards with dogs.[9] Dog walking in Australian woodlands led to a 35% reduction in bird diversity and a 41% reduction in the overall number of birds.[5] The same study showed some disturbance of birds by humans, but typically less than half that induced by dogs.

Studies in California and Colorado showed that bobcats avoided areas where dogs were present, including spatial displacement[22,33,52] and temporal displacement in which bobcats switched to night time for most activities.[22] The Colorado study also demonstrated significantly lower deer activity near trails specifically in areas that allowed dogs, and this effect extended at least 100 meters off-trail.[33] This negative effect was also true for small mammals including squirrels, rabbits, chipmunks and mice, with the impact extending at least 50 meters off-trail.

Evidence suggests that some wildlife species can habituate to certain predictable, non-threatening disturbances such as people walking on a trail in a natural area; this effectively lowers the stress response. Part of this adaptation may be due to wildlife learning what is and isn't a threat, and also

avoidance of hunters.[19,55,63,70] Habituated animals still react, but amount of habitat affected is not as large.[55,56,63,70] However, dogs – especially off-leash dogs – may prevent wildlife habituation because wildlife consistently see them as predators. Dog-specific disturbance has been studied for birds, with no evidence of habituation even with leashed dogs, even where dog-walking was frequent; this effect was much weaker for people without dogs.[5]

Even the scent of dog urine or feces can trigger wildlife to avoid an area. Therefore, the impacts of dog presence can linger long after the dog is gone, even days later. One literature review found that predator odors caused escape, avoidance, freezing, and altered behavior in a large suite of wildlife species including scores of amphibian, reptile, bird, and mammal species from other studies.[30] The scent of domestic dogs has been shown to repel American beaver (*Castor Canadensis*), mountain beaver (*Aplodontia rufa*), deer (*Odocoileus* species), elk (*Cerus elaphus*), and a wide variety of wildlife native to other countries.[20,30] Mountain beaver cause economic damage to young tree stands in the Pacific Northwest, and foresters are considering using dog urine as a repellant.[20] An experimental study demonstrated that dog feces are an effective repellent for sheep, with no habituation observed over seven successive days.[1]

One Colorado study showed mixed effects of dogs on wildlife.[44] The study compared effects of pedestrians alone, pedestrians with leashed dogs and unleashed dogs alone on grassland birds. Vesper Sparrows (*Pooecetes gramineus*) and Western Meadowlarks (*Sturnella neglecta*) waited until dogs were closest to flush – that is, they fly or run away. This could be an attempt to remain undetected against the greatest threat, but could also mean that these bird species perceive humans as a greater threat than dogs. However, the same study found strong dog-specific impacts on mule deer in woodlands. A literature review found that ungulates (deer, elk and sheep) had stronger flight responses in open habitats compared to forested habitats.[63] Unlike small ground-nesting songbirds, larger animals would have no cover and could easily be seen in open habitats.

The disturbance effects of off-leash dogs are stronger than on-leash and substantially expand the amount of wildlife habitat affected,[32,59,63,69] and the unpredictability of off-leash dogs may prevent wildlife habituation in large areas of habitat.[5,10,32,61,69] The negative effects are increased even further when dogs and people venture off-trail, probably because their behavior is less predictable.[44,67] Off-leash dogs are likely to reduce the number and types of wildlife in large areas of habitat.

A Colorado study found off-leash dogs ventured up to 85 meters from the trail, although this result was from 1 square meter plots covering a very small percentage of the area.[33] Remote cameras in another study documented the same dog 1.5 miles apart in the same day.[61] In Utah, mule deer showed a 96% probability of flushing within 100 meters of recreationists located off trails; their probability of flushing did not drop to 70% until the deer were 390 meters from the recreationists.[67] A California shorebird study found that off-leash dogs were a disproportionate source of disturbance, and that plovers did not habituate to disturbance; birds were disturbed once every 27 minutes on weekends.[32]

To illustrate the potential of dogs to displace wildlife we explored two well-known local park examples that allow dogs on leash. Forest Park is one of the largest urban parks in the U.S. and was always intended to connect urban dwellers with nature; people have been walking their dogs there since before the park's 1948 dedication. Forest Park covers 5,172 acres of forest, including approximately 80 miles of trails and service. Using a very conservative 25-meter buffer around mapped trails to represent the "human + dog on leash" area of disturbance and assuming 100% compliance with leash rules, the area affected would be 1,406 acres – that's 28% of the entire park. In 651-acre Tryon Creek Natural Area, 207 acres of land (32%) is within 25 meters of a trail.

DISTURBANCE AND STRESS RESPONSE

Stress response is the functional response of an animal to an external stressor, such as seasonal changes in temperature and food availability or sudden disturbance.[3] Specific stress hormones are released to enable the animal to physically respond to the stressor. Acute stress response, when an animal reacts to an immediate situation, can benefit an animal by triggering it to respond appropriately to a threat. However, chronic stress such as repeated disturbances over time may reduce wildlife health, reproduction, growth, impair the immune system and increase vulnerability to parasites and diseases.[16,27,75]

Dogs cause wildlife to be more alert, which reduces feeding, sleeping, grooming and breeding activities and wastes vital energy stores that may mean life or death when resources are low, such as during winter or reproduction.[8,32,40,41,69] Animals release stress hormones and their heart rates elevate in response.[3,27,37,38] When stress becomes too high, animals may flush, freeze, or hide.[26,30]

Several studies document that disturbance reduces reproductive success for some wildlife species.[11,35,40,50,63] Numerous studies found that female deer and elk, and deer and elk groups with young offspring, show greater flight responses to human disturbances than other groups.[63] Stress hormones may cause male songbirds to reduce their territorial defense, females to reduce feeding of their young, nestlings to have reduced weight and poor immune systems, and adult birds to abandon nests.[11,34,35,76] A Colorado study showed that elk repeatedly approached by humans had fewer young.[50] Although research is lacking on whether dogs specifically reduce the reproductive success of wildlife, the fact that humans with dogs create much stronger disturbance effects than without dogs [5,33,38,41,44,61,68,69] implies that these stress effects would be magnified if people had dogs with them.

INDIRECT AND DIRECT MORTALITY

Dogs chase and kill many wildlife species including reptiles, small mammals, deer and foxes.[12,13,29,31,48,58,62] A Canadian study found that domestic dogs were one of the top three predators that killed white-tailed deer fawns.[4] In northern Idaho winter deer grounds, an Idaho Fish and Game conservation officer witnessed or received reports of 39 incidents of dogs chasing deer, directly resulting in the deaths of at least 12 animals.[36] A study in southern Chile revealed that domestic dogs preyed on

most of the mammal species present in the study area.[60] A 2014 literature review of dogs in parks identified 19 studies that investigated the effects of dogs preying on wildlife.[73] Of these, 13 reported observing or finding strong evidence of dog predation on wildlife. The Audubon Society of Portland's Wildlife Care Center took in 1,681 known "dog-caught" injured animals from 1987 through March 2016.[2]

Dogs transmit diseases to wildlife and vice versa including rabies, Giardia, distemper and parvovirus.[18,23,66,74] A Mexico City study concluded that feral dogs continually transmitted parvovirus, toxoplasmosis and rabies to wildlife including opossums, ringtails, skunks, weasels and squirrels.[66] Large carnivores such as cougars are especially vulnerable to domestic dog diseases including canine distemper.[74]

HUMAN DISEASE AND WATER QUALITY IMPACTS

Under the Oregon Department of Environmental Quality (DEQ), Metro is a Designated Management Agency to protect water quality in compliance with the federal Clean Water Act. Limiting dog access at most natural areas is one of Metro's commitments to DEQ, because dog feces pollute water. Feces are often delivered to waterways through stormwater.[57] The average dog produces ½ to ¾ pound of fecal matter each day – a hundred dogs can produce more than 500 pounds of waste per week.[45] The DEQ identifies pet waste as a significant contributor to one of the region's most ubiquitous and serious pollutants, *E. coli* bacteria. Contact with *E. coli*-polluted water can make people sick. Because dog waste can be a relatively simple source to reduce or eliminate exposure to *E. coli*, DEQ considers reducing or eliminating dog waste an important action item in jurisdictions' clean water implementation plans for the Willamette Basin watershed.[47]

Humans can catch parasites and diseases such as hookworms (causes rash), roundworms (may cause vision loss in small children, rash, fever, or cough) and salmonella (causes gastrointestinal illness) from dog waste.[7,57] Aside from potential illnesses, dog waste can negatively affect visitors' experience in a natural area. Dog waste left on the ground is a leading complaint in Portland parks, and violators may be fined up to $150 per incident.[14]

Several examples illustrate local dog impacts. A Clean Water Services DNA study found that dog waste alone accounts for an average of 13% of fecal bacteria in stream study sites in the Tualatin River Basin.[17] Off-leash dog walking is documented to cause erosion in Portland's Marshall Park, creating sediment problems in stream water.[15] In 2014 Portland school administrators expressed concern because playgrounds had become "a minefield for animal waste" from people using school grounds as after hours, off-leash dog parks, threatening the health of school children.[21] The City of Gresham found extremely high levels of *E. coli* bacteria in water quality samples of a very specific stretch of a stream, where dog feces were found along stream banks behind several yards with dogs.[1] The city sent letters to

[1] Personal communication with Katie Holzer, Watershed Scientist at the City of Gresham, Oregon, 4/11/2016.

residents in the neighborhood about the incident and how to properly dispose of dog feces; the levels have not been elevated in follow-up sampling.

BELIEF, BEHAVIOR AND REALITY

People do not always take responsibility for their impacts on wildlife. Several studies demonstrate that natural area visitors, including dog owners, often don't believe they are having much of an effect on wildlife, or assign blame to different user groups rather than accepting responsibility themselves.[6,64,67,68] Some natural area visitors assume that when they see wildlife, it means that they are not disturbing the animals – or worse, that because they didn't see any wildlife, they didn't disturb any.[64]

For example, in Utah, about half of recreational visitors surveyed did not believe that recreation was having a negative impact on wildlife; of those that did, each user group blamed other groups for the strongest impacts.[67] In Austria, 56% of people surveyed at a national park agreed that wildlife is in general disturbed by human activity.[64] However, only 12% believed that they had disturbed wildlife in their visit that day, and dog-walkers ranked their activities as less disturbing than other user groups' activities. When asking different user groups to rate the impacts of overall human disturbance on wildlife, dog-walkers rated the impacts the lowest, at 2.6 out of 5 possible impact points.

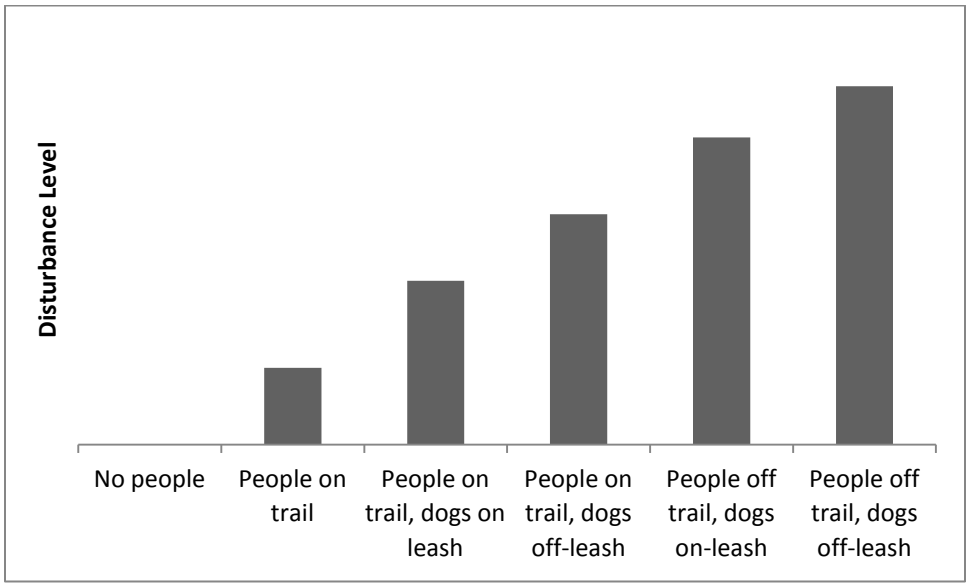
Surveys indicate that many dog owners desire fewer restrictions, while non-dog owners often feel the opposite.[72,73] However dog owners don't always follow the rules, and some dog owners allow their dogs to run free in leash-only natural areas.[32,52,73] In a Santa Barbara study, only 21% of dogs were leashed despite posted leash requirements.[32] And despite regulations and claims to the contrary, dog owners often don't pick up their dog's waste.[6,32] An English study revealed that although 95% of visitors claimed to pick up their dog's waste only 19-46% actually did so, depending on location within the park.[6]

DISCUSSION

In summary, people and their dogs disturb wildlife, and people are not always aware of or willing to acknowledge the significance of their own impacts. Wildlife perceive dogs as predators. Dogs subject wildlife to physical and temporal displacement from habitat, and dog scent repels wildlife with lingering impacts. Dogs disturb wildlife which can induce long-term stress, impact animals' immune system and reduce reproduction. Dogs spread disease to and outright kill wildlife. People with dogs are much more detrimental to wildlife than people alone; off-leash dogs are worse; and off-trail impacts are the highest (Figure 1).

Urban wildlife is subjected to many human-induced stressors including habitat loss, degraded and fragmented habitat, impacts from a variety of user groups, roads, trails, infrastructure, noise and light pollution.[26] These stressors will increase with population; from July 2014 to 2015 the Portland-Vancouver metropolitan region added 40,621 new residents.[43] Current population in the region stands at 2.4 million, with another 400,000 residents expected over the next 20 years.

Figure 1. Conceptual illustration of the relative impacts on wildlife due to people without and with dogs.



Among medium to high density cities, Portland currently ranks second in the total area covered by parks at nearly 18%, and also second in the number of park acres per resident.[25] Of 34 park providers in the Portland region, all but four allow dogs in most or all of their natural areas, typically on-leash; more than two-thirds also offer dog parks or off-leash dog areas (Table 1 at end of document).

Wildlife conservation is not the only valid reason to preserve natural areas. Park providers must weigh the trade-offs between wildlife, habitat, water quality and recreational values. But when considering different types of public access in a natural area, it is important to understand that the research is clear: people with dogs substantially increase the amount of wildlife habitat affected and are more detrimental to wildlife than people without dogs.

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Table 1. Park providers' dog policies in the greater Portland, Oregon metropolitan area.

Parks provider	No dogs allowed	Some parks allow dogs	Dogs allowed	On-leash	Free to roam	Off-leash areas or dog park
Audubon Society of Portland	X					
City of Beaverton		X[2]		X		X
City of Cornelius			X	X[3]		
City of Durham			X	X		X
City of Fairview		X[4]		X		
City of Forest Grove			X	X		X
City of Gladstone			X	X		X
City of Gresham			X	X		X
City of Happy Valley			X	X[5]		X
City of Hillsboro			X	X		X
City of Lake Oswego			X	X		X
City of Milwaukie[6]			X	X		X
City of Oregon City			X	X		X[7]
City of Portland		X		X[8]		X[9]
City of Sherwood			X	X		X
City of Tigard			X	X		X
City of Troutdale		X[10]		X		X[11]
City of Tualatin			X	X		X
City of West Linn			X	X		X[12]
City of Wilsonville			X	X		X
City of Wood Village			X	X		
Clackamas County			X	X		X
Clean Water Services (Fernhill Wetlands)	X					

[2] All parks except fountain provided by Tualatin Hills Parks & Recreation District.
[3] Considering off-leash dog area at Water Park.
[4] Dogs on leash allowed at all parks except Salish Ponds (no dogs).
[5] Dogs on leash except prohibited in playgrounds.
[6] All city parks are operated by North Clackamas Parks and Recreation Department.
[7] The City of Oregon City is currently testing off-leash areas in three parks.
[8] Dogs on-leash except prohibited at Foster Floodplain Natural Area, Tanner Springs Park, Whitaker Ponds Nature Park, Riverview Natural Area, and the amphitheater at Mt Tabor Park.
[9] 33 off-leash dog areas.[46]
[10] Most parks: dogs not allowed. Exception: Sunrise Park and large Beaver Creek Greenway, leash only. Considering two more on-leash dogs allowed parks.
[11] Plans for an off-leash area at Sunrise Park.
[12] One off-leash dog area: field near parking lot at Mary S. Young Park. Off-leash dogs were identified as an issue by parks board.

Parks provider	No dogs allowed	Some parks allow dogs	Dogs allowed	On-leash	Free to roam	Off-leash areas or dog park
Federal / State (Sandy River Natural Area)			X[13]	X	X	X
Metro		X[14]				
N. Clackamas Parks & Recreation			X			X
OR Department of Fish and Wildlife			X	X[15]	X	X
OR Parks & Recreation Department			X	X		X
Port of Portland		X[16]		X		
The Nature Conservancy	X					
The Wetlands Conservancy			X[17]	X	X	
Tualatin Hills Park and Rec. District		X[18]		X		X
U.S. Fish & Wildlife Service	X					
U.S. Forest Service[19]			X	X	X	X

[13] Leashes required only on/near Confluence Trail and in parking area. Leash-off everywhere else. Region's largest off-leash area, and heavily used.

[14] Metro does not allow dogs except for service dogs, leashed dogs on regional trails, Broughton Beach, boat ramps and properties managed by others through intergovernmental agreements that are integrated into larger parks where leashed dogs are allowed (e.g., Forest Park).

[15] All dogs must be on leash, except while hunting during seasons authorized on Sauvie Island Wildlife Area, or pursuant to a valid "Competitive Hunting Dog Trial Permit" or "Sauvie Island Wildlife Area Individual Dog Training Permit."

[16] Includes Vanport Wetlands and mitigation sites. No dogs allowed except Government Island State Recreation Area (leased to Oregon Parks Department).

[17] No formal policy.

[18] Dogs allowed on-leash except Tualatin Hills Nature Park and Cooper Mountain Nature Park.

[19] Refers specifically to the Sandy River Delta, owned and administered by the National Forest Service, Columbia River Gorge National Scenic Area.