

# **Understanding the Ecological Impacts of Dogs in Natural Areas**

**Prepared for**  
**PKOLS-Mount Douglas Conservancy**

**August 4, 2023**

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**Territory Acknowledgement**

PKOLS - Mount Douglas lies within the traditional territories of the WSÁNEĆ peoples, represented by the WJOLEŁP (Tsartlip), BOKÉĆEN (Pauquachin), STÁUTW (Tsawout), WSIKEM (Tseycum) and MÁLEXEL (Malahat) Nations; as well as the the lək wəŋən peoples, represented by the Songhees and Esquimalt Nations. The WSÁNEĆ and lək wəŋən peoples have been here since time immemorial, and their relationship with the land and water is long and rich.

**Author Notes**

This document does not extensively examine the particular and cumulative effects that the factors described herein have on endangered, threatened, and at-risk species and ecosystems in natural areas where dogs are permitted. These factors, in addition to the compounding influences of climate change and other anthropogenic activities should be considered and examined further.

The species referenced in this document are regionally specific to South Vancouver Island, but should not be considered a complete inventory of species present in the areas discussed.

Further information, including a comprehensive list of species, ecological communities, and ecosystems are available via the B.C. Species & Ecosystems Explorer (BCSEE): <https://a100.gov.bc.ca/pub/eswp/>

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The author is a current and life-long dog guardian, animal foster volunteer, pet care provider, and former animal therapy handler.

## Executive Summary

### Overview

- The evidence that dogs have a detrimental impact on wildlife and ecological health is supported by current scientific literature
- Wildlife perceives dogs (a subspecies of wolves) as predators
- Any human-related activity has the potential to disturb wildlife
- People with dogs cause more harm to wildlife and ecological integrity than people visiting natural areas without dogs
- People recreating in natural areas are likely to underestimate the influence their presence and activities have on wildlife
- Responsible ownership practices have the potential to mitigate some of these impacts

### Temporary and Permanent Displacement of Wildlife

- The presence of dogs in natural areas results in the displacement of wildlife
- Repeated displacement diminishes available habitat for wildlife
- Reduction in available habitat can detrimentally affect the long-term viability of species' populations within regions
- In the presence of dogs, wildlife activity is lower up to 100 metres off-trail

### Particular Impacts on Ground-Nesting Species

- Dogs permitted in ground-nesting bird habitat can cause various adverse consequences
- Woodland habitats permitting dogs showed a 35% reduction in bird diversity and a 41% reduction in abundance compared to areas prohibiting dogs.
- Off-trail dog activity can disrupt and damage critical nesting grounds for various species
- Cumulative disturbances can lead to wildlife displacement and population decline

### Disturbance of Wildlife through Acute and Chronic Stress

- The presence of dogs alarms wildlife and disrupts their routine activities.
- Repeat disturbance leads to higher energy expenditure and release of stress hormones
- Displacement and stress disrupts feeding, breeding, and resting opportunities for wildlife
- Repeated stress hormone release can result in reduced reproductive success, immune system dysregulation, and increased vulnerability to disease, and mortality

### Predation Avoidance Response

- Dog scent, urine, and feces can linger and deter wildlife even after the dog has left

- Many species rely on strong olfactory systems to find food, habitat, and detect threats
- The residual scent left by dogs and their waste signals to wildlife the presence of a predator, triggering an instinctual predation avoidance response

### Wildlife Mortality Through Predation and Disease

- Off-leash dogs pose an immediate risk to wildlife mortality through predation
- Dogs can transmit diseases and pathogens to susceptible wildlife species
- Outbreaks of *Canine distemper virus* spread by domesticated dogs have been reported in wildlife in British Columbia

### Dog-Specific Degradation of Ecosystems in PKOLS (Mount Douglas Park)

- The BC Conservation Data Center designates all ecosystems in the park as red-listed or blue-listed, indicating at-risk or of special concern status
- The entire boundary of PKOLS (Mount Douglas Park) has been mapped by the Sensitive Ecosystems Inventory (SEI) Project which identifies rare and fragile terrestrial ecosystems
- The SEI does not include aquatic habitats however, these areas are of equal importance and face a unique set of vulnerabilities
- Douglas Creek is critical habitat for three salmonid species, and restoration efforts have improved its health and salmonid populations
- Videos of dogs in the park engaging in destructive behaviours highlight their contribution to ecosystem degradation
- These behaviours are a direct result of the presence and activities of dogs rather than the inherent interactions of wildlife within their natural environments
- Native animals and plants have coevolved with one another, and their interdependent interactions are essential for maintaining healthy ecosystems
- Recognizing this distinction allows for the development of responsible pet ownership practices, and appropriate ecological restoration initiatives

### Disruption of Fundamental Ecosystem Processes

- Dog activity has extensive impacts on native vegetation, ranging from immediate destruction to long-term degradation of ecological communities and ecosystems
- These impacts include disturbance through trampling, foraging, changes in soil composition, compaction, and erosion
- These factors can threaten the health of native plant communities

- The four fundamental components of every terrestrial ecosystem are *Nutrient Cycling, Water Cycling, Plant and Animal Succession, and Energy Flow*

#### **Disruptions to Nutrient Cycling Through Dog Waste**

- Dog urine and feces are high in nitrogen and phosphorus, disrupting nutrient cycling in native ecosystems
- Overfertilization with nitrogen can harm native plants, favouring invasive species in nitrogen-rich soil environments
- Some invasive plants (such as Scotch broom) form symbiotic relationships with nitrogen-fixing bacteria, further facilitating their spread
- Dogs hinder restoration efforts in natural areas by increasing nitrogen levels, trampling native growth, and compacting soil
- Failure to remove dog waste can lead to excess nitrogen and phosphorus in waterways, harming aquatic life
- Removing dog feces helps reduce nitrogen in soils and water
- Dog owners with on-leash dogs are more likely to remove waste than those with off-leash dogs
- Implementing leash mandates and educational outreach may improve waste removal compliance and reduce the impact on sensitive ecosystems

#### **Disruptions to Water Cycling Processes**

- Trampling and off-trail usage can disrupt water cycling in ecosystems
- Off-trail activity leads to soil compaction, reducing water absorption capacity.
- Reduced plant presence increases rainfall interception, reducing available water for other species and contributing to runoff and erosion
- Dog urine, which cannot be removed from soils, has high nitrogen and low pH levels which may further reduce soil water absorption capacity and diversity of soil microbiome
- This contributes to localized water runoff, soil erosion, and altered ecological community compositions

#### **Increased Risk of Sedimentation in Salmon Habitats**

- Ecosystems supporting salmon habitat are particularly vulnerable to increased soil erosion and water runoff
- Altered soil composition can lead to sedimentation in streambeds
- Dogs entering salmon habitat can destroy gravel redds and stir up sediments
- Excess sedimentation is a major mortality risk to salmon eggs

#### **Bringing Ecological Understanding Across Regions of Study**

- Studies in a variety of countries and environments confirm that dogs in natural areas and along trails significantly alter wildlife activity and ecological processes
- Findings from studies in other regions may be applied to South Vancouver Island, as fundamental ecological processes and principles are consistent globally
- Specific research on the *Coastal Douglas fir (CDF) Biogeoclimatic Zone* is needed due to it having highest number of species and ecosystems at risk in the entire province
- Saanich is located entirely in the *Moist Maritime Coastal Douglas fir (CDFmm) Subzone* and is home to some of the most endangered ecosystems in all of Canada
- Studies specific to Saanich would be of particular importance

#### **Conclusion**

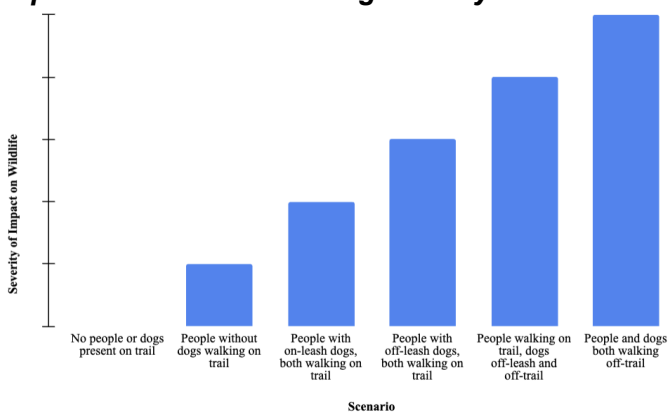
- The evidence highlighting the detrimental impacts that dogs have on individual species, ecological communities, and ecosystems is abundantly clear
- Existing scientific literature provides a foundation to understand these impacts and make informed decisions about recreation in natural areas
- Embracing responsible pet ownership, education, and restoration efforts can lead to a healthier, more resilient planet and harmonious coexistence among species

**Introduction**

The evidence that dogs have a detrimental impact on wildlife and ecological health is overwhelmingly and consistently supported by current scientific literature and our understanding of fundamental ecological processes. Dogs (*Canis lupus familiaris*) are a subspecies of wolves (*Canis lupus*) and as such, wildlife inherently perceives dogs as predators within their natural habitats.<sup>(1)</sup>

While any human-related activity has the potential to disturb wildlife, it is evident that people with dogs (both on-leash and off-leash) cause more harm to wildlife and ecological integrity than people visiting natural areas without dogs.<sup>(2,3,4,5,6,7,8,9,10,11)</sup> Studies indicate that people walking on their own have the lowest impact on disturbing wildlife behaviour, the exception being natural areas where people are not present.

**Figure 1: Conceptual Chart Illustrating the Impacts of Human and Dog Activity on Wildlife**



Studies show that people recreating in natural areas are likely to underestimate the influence their presence and activities have on wildlife, or attribute the blame to other user groups altogether.<sup>(12,13,14,15)</sup> The results of these studies indicate that visitors to natural areas of all user groups often believe that seeing any wildlife during their visits suggests they are not causing any disturbance to the animals. Particularly noteworthy was the belief among some respondents that if they did not encounter or witness any wildlife, then no disturbance occurred.<sup>(13)</sup>

When surveyed about their perceived impact of their activities in natural areas, the user group

representing dog walkers ranked their perceived impact at the lowest end of the scale compared to all other user groups surveyed. These results highlight the discrepancy between perception and impact, as individual biases and subjective judgements have the potential to influence an individual's evaluation of their influence and activities in natural areas.

In order to protect and preserve the ecological integrity of our natural areas and reduce the negative effects on wildlife, all user groups must take accountability for the impacts of their recreational activities and make reasonable adjustments to their behaviours in order to prevent further ecological destruction and degradation. This cannot be accomplished, however, if each user group does not have access to the relevant information relating to their specific activities. As a frequent user group in natural areas, dog owners, guardians, and walkers bear a crucial responsibility to acknowledge and understand the impact their activities can have on the health and wellbeing of local wildlife, habitats, and ecosystems.

Numerous factors provide clear evidence of the negative consequences that dogs can inflict upon wildlife and natural environments. While each of these factors outlined below possesses its own inherent capacity for harm, it is critical to recognize the amplified magnitude that their cumulative and intersecting effects have on overall ecological integrity. The repetitive, collective impacts of thousands of humans and dogs engaging in activities within one natural area on a daily basis have the highest potential for harm, even though the actions of a single human and dog on a given day may seem negligible.

It is important to state that this document is not intended to cast blame on or fault to the dogs themselves, as their behaviours are largely influenced by the rules of biological instinct and wildlife ecology. There are a considerable number of responsible ownership practices that may have the potential to mitigate some of the impacts referenced. It's equally important to acknowledge that the evidence presented below should not diminish nor invalidate the physical and mental health benefits that both humans and dogs may

derive from recreating in natural areas with each other.

For thousands of years, dogs have played a significant role within human societies, and their value as cherished companions is not one that is in dispute. As population growth rates continue to increase in the Capital Regional District, so too does the need to further understand the implications that dogs have on natural areas already facing increased pressures from urbanization, climate change, and other anthropogenic activities.

### **Temporary and Permanent Displacement of Wildlife**

The presence of dogs in natural areas and along trails has a significant impact on wildlife, resulting in both temporary and permanent displacement in a variety of affected species.<sup>(4,6,7,16,17,18,19)</sup> Repeated occurrences of such displacement diminishes the available habitat for wildlife to carry out essential activities such as feeding, breeding, and resting. As a result, animals may alter their activity patterns, becoming less active at certain times and vacating areas of otherwise preferred habitat to avoid interactions with dogs.<sup>(4,20,21)</sup> A study on the spatial displacement of deer in response to the presence of dogs on trails demonstrated lower animal activity up to 100 metres off-trail. This negative displacement effect also extended to smaller mammals, which demonstrated altered activity up to 50 metres off-trail.<sup>(4)</sup>

In natural areas located within urbanized regions where available intact habitat is increasingly diminishing or has been almost entirely extirpated, the preservation of these remaining wildlife corridors are critical to the survival of individual species and the ecological communities they support. Further fragmentation of such habitats can detrimentally affect the long-term viability of a species' population within a specific region.

### **Particular Impacts on Ground-Nesting Species**

Many native species of birds such as Dark-eyed junco (*Junco hyemalis*), Pacific wren (*Troglodytes pacificus*), Bewick's wren (*Thryomanes bewickii*), Orange-crowned warbler (*Leiothlypis celata*), Song

sparrow (*Melospiza melodia*), White-crowned sparrow (*Zonotrichia leucophrys*), Wilson's warbler (*Cardellina pusilla*), Spotted towhee (*Pipilo maculatus*), and others nest on or near the ground.<sup>(22)</sup> The recurrent presence of dogs in close proximity to their nesting habitat can lead to a multitude of adverse consequences ranging from immediate disturbances to long-term impacts on local species populations. Nests may be damaged or predated, parent birds may become displaced, delay incubation, neglect feeding their young, and may ultimately abandon the nest or nesting habitat altogether. A study comparing woodland habitats that permit dogs to areas that prohibit dogs showed a 35% reduction in bird diversity and a 41% reduction in abundance in areas where dogs were permitted.<sup>(2)</sup>

An additional factor to consider beyond the immediate disturbance or predation of wildlife is the impact that off-trail dog activity has on the availability of suitable nesting habitat. When off-leash dogs are permitted to repeatedly venture off designated trails, they can unknowingly disrupt and damage terrestrial habitat that serves as critical nesting grounds for a wide variety of species through trampling, digging, and scratching at the ground.

These impacts also extend to amphibian and reptile species that nest in terrestrial, aquatic and semi-aquatic wetland habitats, including Pacific tree frogs (*Pseudacris regilla*), Western redback salamanders (*Plethodon vehiculum*), Rough-skinned newt (*Taricha granulosa*), Northern alligator lizards (*Elgaria coerulea*), and the endangered Western painted turtle (*Chrysemys picta bellii*).

The immediate and cumulative effects of repeated disturbances can lead to a significant reduction in the availability and quality of nesting habitat, resulting in permanent wildlife displacement and regional population decline.<sup>(2)</sup> Additional research into the comparative impacts that on-leash and off-leash dogs have on ground-nesting species would be beneficial.

### **Disturbance of Wildlife through Acute and Chronic Stress**

Wildlife is instinctually alarmed by the presence of

dogs, which can lead to disruption of their routine activities. This increased disturbance requires animals to expend more energy, increases stress hormones and reduces essential opportunities to feed, breed, and rest. The repeated release of stress hormones as a result of interactions with dogs can have both immediate and long-term impacts on wildlife, including reduced reproductive success, immune system dysregulation, and increased vulnerability to disease, disorientation, and mortality.<sup>(23,24,25)</sup>

### Predation Avoidance Response

The scent of dogs, dog urine, and dog feces, can linger and repel wildlife long after the dog has physically left an area.<sup>(1)</sup> Many species of mammals such as Columbian black-tailed deer (*Odocoileus hemionus columbianus*), Raccoon (*Procyon lotor*), American red squirrel (*Tamiasciurus hudsonicus*), Western deer mouse (*Peromyscus sonoriensis*), American mink (*Neogale vison*), Townsend's vole (*Microtus townsendii*), North American river otter (*Lontra canadensis*); amphibians including Pacific tree frog (*Pseudacris regilla*), Western redback salamander (*Plethodon vehiculum*), Rough-skinned newt (*Taricha granulosa*); reptiles such as Northern alligator lizard (*Elgaria coerulea*), Northwestern garter snake (*Thamnophis ordinoides*); and birds including Dark-eyed junco (*Junco hyemalis*), Rufous hummingbird (*Selasphorus rufus*), Anna's hummingbird (*Calypte anna*), Turkey vulture (*Cathartes aura*) rely on highly-developed olfactory systems to locate food sources, identify suitable habitats, and detect potential threats. The residual scent left by dogs and their waste signals to wildlife the presence of a predator, triggering an instinctual predation avoidance response.

### Wildlife Mortality Through Predation and Disease

The presence of off-leash dogs poses an immediate and heightened risk to wildlife mortality.<sup>(19,26,27,28,29,30,32 33,34,35)</sup> When dogs are permitted to roam freely in areas inhabited by perceived prey, their instinctual predatory behaviour can lead to the injury or death of susceptible species through chasing and predation.

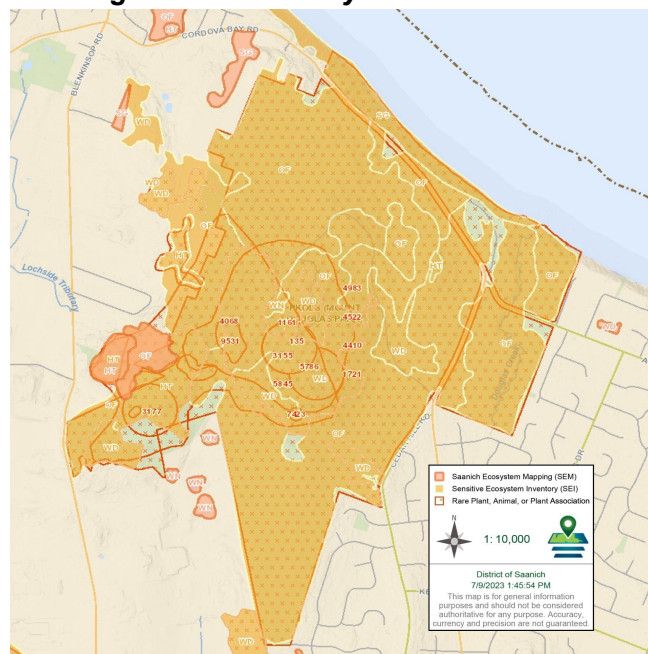
Domesticated dogs are capable of transmitting diseases and pathogens such as *Rabies lyssavirus*, *Canine distemper virus*, *Giardia duodenalis*, *Canine*

*parvovirus*, *Leptospirosis*, and *Toxoplasma gondii* to susceptible wildlife species.<sup>(36,37,38,39)</sup> Although dogs account for the majority of *Rabies* cases worldwide, bats are currently identified as the only known carriers in British Columbia.<sup>(40)</sup> Unvaccinated dogs in particular are capable of spreading *Canine distemper virus* to canid and mustelid species, which may cause serious illness or death in affected wildlife. Outbreaks of this disease believed to be spread by domesticated dogs have been reported in wildlife throughout British Columbia.<sup>(41)</sup>

### Dog-Specific Degradation of Ecosystems in PKOLS (Mount Douglas Park)

The entire boundaries of PKOLS (Mount Douglas Park) have been mapped by the Sensitive Ecosystems Inventory (SEI) Project (*Figure 2*). The purpose of the SEI is to create a comprehensive map of the remaining fragments of rare and fragile terrestrial ecosystems on South Eastern Vancouver Island and the Gulf Islands<sup>(42)</sup>

**Figure 2: Map of PKOLS (Mount Douglas Park) Showing Sensitive Ecosystems**



A map of PKOLS (Mount Douglas Park) with data overlay from the Sensitive Ecosystem Inventory Project and confirmed presence of rare species.

Available: [https://map.saanich.ca/html5viewer/?viewer=Public&\\_ga](https://map.saanich.ca/html5viewer/?viewer=Public&_ga)

Although the SEI does not include aquatic habitats such as streams, lakes, and marine areas, these areas are of equal importance and face a unique



set of vulnerabilities in their own right. Douglas Creek, located entirely within the boundaries of PKOLS (Mount Douglas Park) is critical habitat for three species of salmonids: Chum salmon (*Oncorhynchus keta*), Coho salmon (*Oncorhynchus kisutch*), and Cutthroat trout (*Oncorhynchus clarkii*). Ongoing efforts to restore the in-stream and riparian habitats of Douglas Creek since 1995 have significantly enhanced the overall health of the creek, resulting in an annual return of salmonids beginning in 1999.

The BC Conservation Data Center has designated all ecosystems found within PKOLS (Mount Douglas Park) as either red-listed (*at risk of being extirpated, endangered or threatened*) or blue-listed (*of special concern*).<sup>(22)</sup> Videos featuring dogs in PKOLS (Mount Douglas Park) engaging in destructive behaviours such as digging holes, trampling native flora, and pulling branches from Western yew (*Taxus brevifolia*) and Western red cedar (*Thuja plicata*) trees serve as compelling evidence which highlights a number of ways that dogs contribute to the degradation of these sensitive ecosystems.

**Figure 3: Screen Captures Showing Dogs Digging In Tree Root Zones**



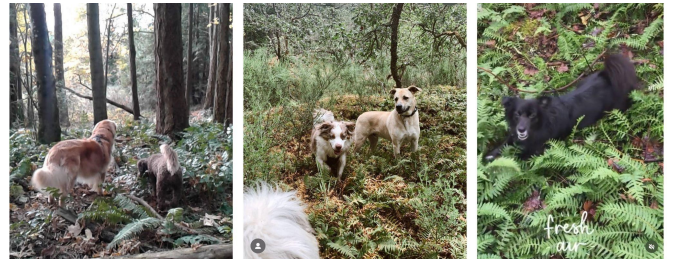
Image stills from videos in which multiple off-leash dogs are encouraged to dig holes in the root zones of mature Western redcedar (*Thuja plicata*) and Douglas fir (*Pseudotsuga menziesii*) trees in PKOLS (Mount Douglas Park). Instagram [redacted] (2023)

**Figure 4: Screen Captures of a Dog Pulling Branches from a Western yew**



Image stills from a video in which an off-leash dog is encouraged to pull and remove branches from a Western yew (*Taxus brevifolia*) tree in PKOLS (Mount Douglas Park). Throughout the video, the dog is permitted to repeatedly venture off-trail and trample understory species, primarily dull-Oregon grape (*Mahonia nervosa*). Instagram [redacted] (2023)

**Figure 5: Photos of Off-leash Dogs Permitted Off-Trail in Coastal Douglas-fir Understorey**



The predominant species seen in these images are Western sword fern (*Polystichum munitum*) and dull-Oregon grape (*Mahonia nervosa*). Instagram [redacted], [redacted], [redacted]. (2019, 2021, 2022).

**Figure 6: Screen Captures of a Video of Dog Pulling Branches from a Western redcedar**



Screen captures showing an off-leash dog repeatedly pulling branches of a mature Western red cedar (*Thuja plicata*) tree in an area of PKOLS (Mount Douglas Park) mapped as Older Second Growth Forest (≥100 to ≤250 years) by the SEI. (2021)

Over thousands of years of coevolution, native animals have developed a complex codependency with native plants, relying on them both directly and indirectly for survival. This interdependence is crucial for maintaining the delicate balance of ecological communities and ecosystems, ensuring



the long-term viability of native species. These intricate relationships and interactions between organisms provide the foundation for a healthy ecosystem. When the health of native plant communities are compromised or disrupted, this ultimately impacts native animal communities, wreaking havoc on ecological systems.

It is imperative to emphasize that these destructive behaviours as described and illustrated above are a direct result of the presence and activities of dogs rather than the inherent interactions of wildlife within their natural environments. Native animal species have evolved over time to adapt to their specific habitats and have established intricate relationships with other organisms within the ecosystems they comprise. Differentiating between the impacts of native species, which are typically beneficial, and the detrimental effects that arise from the presence of introduced species, is crucial. Recognizing this distinction allows for the prioritization and implementation of responsible pet ownership practices, and encourages the development of appropriate ecological restoration initiatives. Such efforts are critical in minimizing the adverse impacts that dogs have on natural environments, particularly those that are endangered, threatened, or at-risk.

### **Disruption of Fundamental Ecosystem Processes**

The impact of dog activity on native vegetation is extensive, and can vary from immediate destruction to the long-term degradation of ecological communities and the ecosystems they support. This includes disturbance through trampling, foraging, changes in soil composition, soil compaction, and soil erosion. All of these contributing factors have the individual and cumulative potential to threaten the health of native plant communities.

There are four ecosystem processes that are fundamental components of every terrestrial ecosystem: *Nutrient Cycling*, *Water Cycling*, *Plant and Animal Succession*, and *Energy Flow*

#### **Disruptions to Nutrient Cycling Through Dog Waste**

Disruptions to the nutrient cycling processes can have profound effects on the structure and function of native ecosystems. Dog urine and feces are high in both

nitrogen and phosphorus as a result of the high-protein diet of dogs and the subsequent breakdown of these proteins into nitrogen-rich waste byproducts.<sup>(43)</sup> Overfertilization through nitrogen can have profound consequences for the native plants of Garry oak and related ecosystems in particular, which are adapted to thrive in nitrogen-poor soil conditions.<sup>(44)</sup>

Many non-native plant species flourish in nitrogen-rich soil environments, enabling the proliferation of invasive plants to the detriment of native plants that require low nitrogen environments.<sup>(44)</sup> This includes a number of highly invasive and noxious species present on South Vancouver Island, including Himalayan blackberry (*Rubus armeniacus*), Scotch broom (*Cytisus scoparius*), English ivy (*Hedera helix*), Gorse (*Ulex europaeus*), Orchard grass (*Dactylis glomerata*), Spurge-laurel (*Daphne laureola*), Garlic mustard (*Alliaria petiolata*), and Yellow flag iris (*Iris pseudacorus*).<sup>(45)</sup>

Further contributing to this issue, both Scotch broom (*Cytisus scoparius*) and Gorse (*Ulex europaeus*) readily establish symbiotic relationships with nitrogen-fixing bacteria known as rhizobia, which reside on their root nodules beneath the soil.<sup>(46)</sup> This mutualistic association between organisms allows these plants to convert atmospheric nitrogen (N<sub>2</sub>) into ammonia (NH<sub>3</sub>), leaching additional nitrates (NO<sub>2</sub> and NO<sub>3</sub>) into the surrounding soil which further facilitates the spread of these invasive species, allowing them to thrive in an altered soil environment that enables them to outcompete native species.

When dogs are permitted to venture into natural areas that have been restored through the removal of invasive plants and reintroduction of native plants, such efforts may be hindered by a number of compounding factors. Nitrogen levels in the soil can drastically increase due to the occurrence of increased dog urine and feces, continuing a harmful cycle of invasive species colonization before a healthy native plant community is able to become established. In addition, the risk of trampling on native vegetative growth is heightened, and the compaction of soil due to off-trail activity may further impede the growth of native plants, as many invasive species readily thrive in both compacted and disturbed soils.

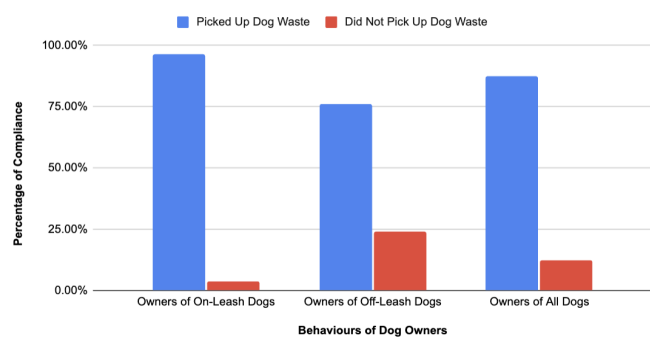
Failure of owners to remove their dog's waste has consequences beyond the negative impacts on plant life, with additional risks extending to aquatic life.<sup>(43, 47)</sup> Through a process called nitrification, the excess nitrogen in dog feces left to decay in natural areas releases ammonia which may be washed directly into waterways or leached into groundwater. Excess ammonia levels in waterways are toxic to aquatic life.

Similarly, through a process called eutrophication, high levels of phosphorus and nitrogen from decaying dog waste can lead to excessive phytoplankton activity in affected waterways. Toxic algae blooms caused by eutrophication result in the depletion of oxygen from aquatic habitats, and can have devastating impacts on aquatic species, particularly in salmonid habitats.

While the act of removing dog feces can serve to diminish the nitrogen levels present in the surrounding soils and waterways, this measure alone fails to fully tackle the predicaments posed by the inability to remove dog urine from the soil.<sup>(47)</sup> Moreover, the tendency of dogs to repeatedly relieve themselves in the same location as one another results in localized accumulations of heightened nitrogen content, further exacerbating the challenges at hand. A study focusing on the nutrient fertilization of dogs in semi-urban ecosystems found that areas permitting dogs have a profound effect on soil nutrient composition, particularly along walking trails and within off-leash dog parks.<sup>(43)</sup>

One Colorado-based study focusing on the behaviours of dog owners regarding the removal and disposal of dog waste in a natural park found those with on-leash dogs were approximately 20% more likely to remove their dog's waste in comparison to those with off-leash dogs.<sup>(48)</sup> Implementation of leash mandates, educational outreach, and signage which explains the harmful impacts of dog waste may increase compliance with waste removal while lessening the overall impact on sensitive ecosystems and watershed health.

**Figure 7: Compliance of Waste Removal in Owners with Off vs. On-Leash Dogs**



**Disruptions to Water Cycling Processes**

Seemingly minor disturbances such as trampling vegetative growth and repetitive off-trail usage can have a profound impact on the fundamental ecological process of water cycling within affected ecosystems. Off-trail activity results in soil compaction, an occurrence where soil particles are tightly packed together, leaving less room for air and water. This may lead to higher soil

density, impede the growth of roots and emergence of seedlings, and diminish the soil's capacity to absorb water.

The reduced presence of plant communities within a particular area may also increase rainfall interception (the amount of rain that falls onto vegetation and is evaporated before it reaches the ground), thereby reducing the availability of that rainwater to other species and further contributing to water runoff and soil erosion. A study on the impacts that dog urine has on soil composition found that the high nitrogen and low pH levels of dog urine can also result in the reduced capacity of soil to absorb rainwater.<sup>(49)</sup> This in turn can reduce soil microbiome diversity and increase localized water runoff and soil erosion, ultimately leading to altered compositions of ecological communities.

**Increased Risk of Sedimentation in Salmon Habitats**

Ecosystems that support salmon habitat are particularly vulnerable to the impacts of increased soil erosion and water runoff, as altered soil composition can lead to the rapid accumulation of sediments in nearby streambeds, in a process referred to as sedimentation. These risks are compounded when dogs are permitted to enter salmon habitat, potentially leading to the destruction of gravel redds, and stirring up of sediments that may suffocate young salmon. Although salmonids have adapted to manage naturally occurring sediments, disturbances that cause excess sedimentation pose one of the highest mortality risks to salmon eggs.<sup>(50,51)</sup>

**Bridging Ecological Understanding Across Regions of Study**

Although studies on the ecological impact of humans and dogs on wildlife in natural areas have predominantly focused on other regions and countries, the findings and insights derived from these studies may also be applied to South Vancouver Island. While the specific species and environmental characteristics may vary between regions, many ecological processes and principles remain consistent across the globe. Studies on a diverse range of wildlife in a variety of countries and environments clearly indicate that dogs in natural areas and on trails cause significant alteration of wildlife activity and behaviour and disruption to ecological processes.

The studies cited in this report shed light on the interactions between humans, dogs, wildlife, and ecological integrity by identifying patterns, mechanisms, and potential mitigation strategies

that can be broadly relevant to ecological communities and habitats outside the initial area of study. Ecological processes, the sensitivity of wildlife to disturbance, the effects of both human and dog presence on animal behaviour, and the impacts of recreational activities on ecological integrity, are fundamental and remain applicable across a variety of geographic regions. Additionally, the general principles of wildlife management, habitat conservation, and our understanding of healthy ecosystems may be considered transferable concepts.

It is important to emphasize the need for research specific to the Coastal Douglas fir (CDF) Biogeoclimatic Zone, particularly that of the less abundant Moist Maritime Coastal Douglas fir (CDFmm) Subzone. Such studies should be conducted in order to capture the intricacies and nuances of the region’s unique biodiversity.

**Figure 8: Map of The Coastal Douglas Fir Biogeoclimatic Zone & Subzones in British Columbia**

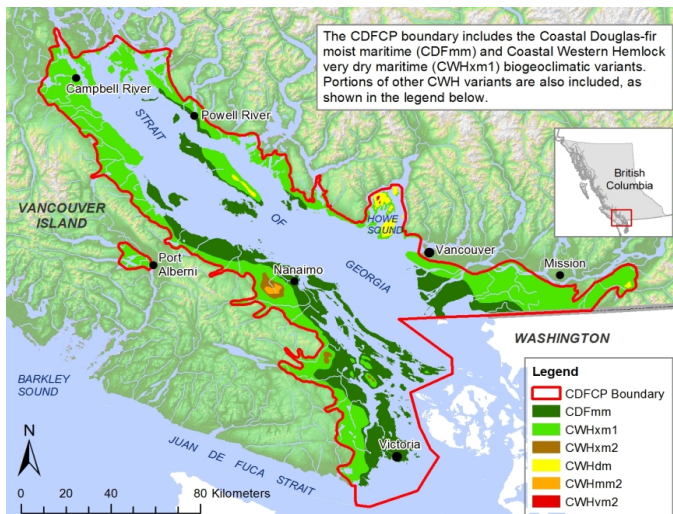


Image Courtesy of the Coastal Douglas-fir & Associated Ecosystems Conservation Partnership. Available: <https://www.cdfcp.ca/about-the-cdfcp/>

Although it encompasses only 0.3% of the province of British Columbia, the CDF Zone holds the highest number of species and ecosystems at risk in the entire province.<sup>(22)</sup> The District of Saanich and each of its bordering municipalities in the Capital Region District (Oak Bay, Victoria, Esquimalt, View Royal, Highlands) are located entirely in the CDFmm Subzone. The ecosystems found within

this subzone are among the most threatened ecosystems and ecological communities in all of Canada.

Studies measuring the ecological impact of dogs specific to the District of Saanich would be of particular importance due to the municipality’s increasing population, high level of biodiversity and ecological value, as well as the confirmed presence of 184 species at risk and several of the most endangered ecosystems in all of Canada.<sup>(22)</sup> Such studies are necessary to build upon the existing body of scientific knowledge and provide regionally specific insights to inform conservation and environmental management policies at municipal, provincial, and federal levels.

**Conclusion**

The evidence highlighting the detrimental impacts that dogs have on individual species, ecological communities, and ecosystems is abundantly clear. The scientific literature and information currently available provides us with a solid foundation upon which to understand associated impacts and risks, and subsequently make informed decisions on how we choose to recreate in natural areas. By understanding these effects, embracing responsible pet ownership practices, fostering educational opportunities, and engaging in collaborative restoration and conservation efforts, we may begin to pave the way for a healthier, more resilient planet and secure a harmonious coexistence between all species, for generations to come.

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