University of Nevada
Cooperative Extension

Fact Sheet–

Dog Wastes and Water Quality:

Evaluating the Risks at Lake Tahoe

This fact sheet discusses research that examined the risk of water contamination from a popular dog exercise area. The study consisted of water sampling and estimating the total amount of dog wastes deposited over the course of 14 months. The study found that a substantial mass of dog wastes accumulated over the course of the study (approximately 100.1 lbs (45.5 kg) of dry matter) and that accumulations were highly localized. However, it found no link between bacteria in water and accumulations. Populations of *E. coli*, a microbe that indicates water contamination from the feces of mammals, degrade quickly when evaporative conditions are high. Land managers can control waste accumulations to minimize the potential for water pollution using several strategies, which are reviewed briefly here.

DOG WASTES AND WATER QUALITY

Recently, in Lake Tahoe and many other areas in the United States, people have become concerned about the effects of accumulated dog wastes on water quality. Dog wastes, like any wastes, may contain very large numbers of microbes, some of which could cause disease. If enough dog waste accumulates in an area, it could contaminate water, which could affect human health. Examples of diseases that can be transmitted from dogs to humans through feces include salmonellosis, giardiasis and cryptosporidiosis (see www.agnr.umd.edu/CES/Pubs/PDF/FS703.pdf for a list of the disease-causing microbes that could be present in dog wastes).

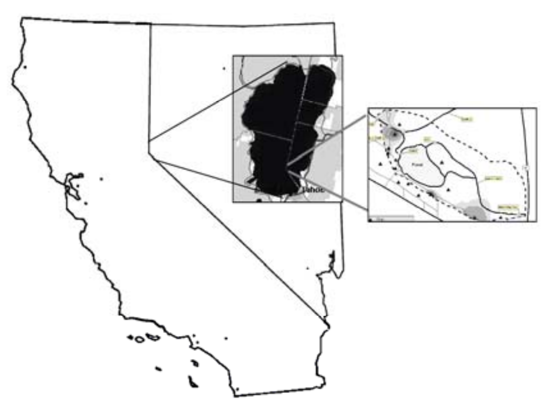

Figure 1: Location of the study site on east side of Lake Tahoe, in Nevada.

Open spaces such as parks and walkways are often used as exercise areas for dogs. In many places, dog-owners are encouraged to collect and dispose of dog wastes, with judiciously placed bag dispensers and waste cans. However, in some areas without waste collection facilities people often worry that accumulated dog wastes can also affect human health in downstream areas.

We investigated the connection between accumulations of dog wastes and the quality of water in a small tributary to Lake Tahoe (figure 1), to see if *E. coli* levels in the tributary changed when dog wastes accumulated in the exercise area. The results have some interesting implications for how bag stations and receptacles should be sited to help dog owners keep trails and recreation areas clean.

HOW AND WHERE THE STUDY WAS DONE

We carried out the study in an areas criss-crossed by a popular trail system managed by the U.S. Forest

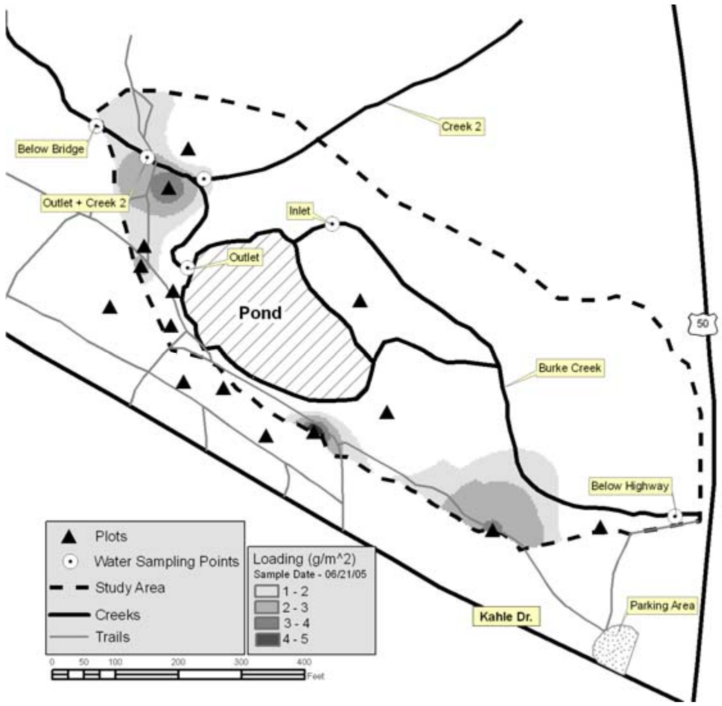

Figure 2: the Burke Creek Recreational Area study site at Lake Tahoe. Triangles represent plots where dog wastes were collected. This figure shows the estimated amounts of dog wastes accumulated during a two week period ending

Service at Lake Tahoe. The trails led to the lake, and passed by a small pond that lay in the middle of the stream course of Burke Creek (Figure 2). Before conducting the study we observed that many residents drove their dogs to a small parking area, to walk, run and cycle with them. Because there were no bag dispensers or waste cans, very few people collected and disposed of wastes. In fact, when walking the trails, we found heavy accumulations of dog wastes in many parts of the area.

The study area covered 8.8 acres. Within the boundaries of the study area, we selected 15 places to collect dog wastes and five sites to sample water. The water sampling sites started from where Burke Creek entered the study area (called *Below Highway (BH)* in Figures 2 and 3), to where it left the study area (*Below Bridge (BB)*). Every two weeks we collected wastes from the sampling points and dried and weighed them. We took water samples from across the study area on the same schedule. We also determined how many *E. coli* could be found in dog wastes. Finally, we carried out experiments to determine how long *E. coli* could survive in canine feces when exposed to different rates of evaporation.

We estimated the total accumulations of wastes by developing maps of the mass of wastes per unit area. We reported results of water sample analysis as "colony forming units (CFU)/100 ml of water." A colony forming unit is a microbial colony–a shiny round spot–that forms on the surface of the filters used to filter up to 100 ml of water (slightly less than seven tablespoons). As an example, if a water sample has 10 CFU/100 ml, this indicates that there were at least 10 microbes that formed colonies when a 100 ml water sample was filtered.

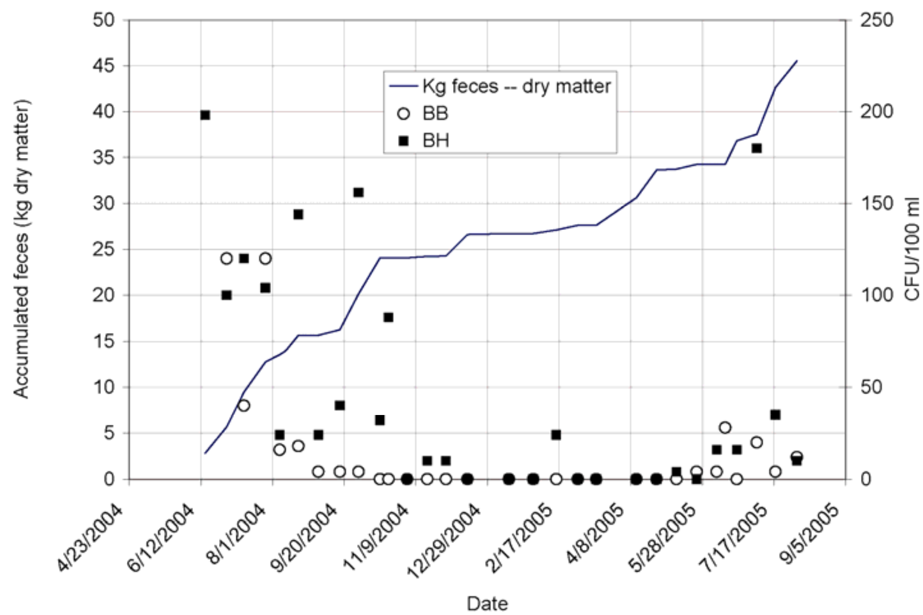

Figure 3: Accumulations of dog waste (left y-axis) and water sampling results at the inlet to the study site (BH) and outlet from the study site (BB) over the 14 month study period (x-axis)

THE RESULTS

***E. coli* in Wastes and Water Content:** Dog wastes were an average of 47% water and a gram (slightly less than 0.04 ounces) of fresh feces contained an average of 50 million CFU/gram with a range of 2 million to 200 million CFU/g. The wide range can be attributed to the highly variable nature of dog food, digestive health and diets.

Waste Accumulations: Dog wastes were distributed very unevenly throughout the study site. Most wastes accumulated in areas that were either very close to trail heads or where trails crossed (Figure 2). This is likely because of canine territory marking behaviour and preference for certain kinds of toilet areas. Overall, approximately 100 pounds of wastes, as dry matter, accumulated in the study area over the course of 14 months. The accumulations differed by season, with much less in winter months than in other seasons. This was likely because the site was covered with snow and inaccessible.

Link Between Water Samples and Waste Accumulations: Sampling did not show extensive water contamination or a link between accumulated dog wastes and *E. coli* in Burke Creek (Figure 3). In fact, we found that in general water leaving the study area had fewer CFU/100 ml than water entering the study area. This may have been due to a wetland through which the creek meandered and a small pond in the stream course that was designed to trap sediment. Although numbers of *E. coli* CFU/100 ml were occasionally high, no single sample from water leaving the study area exceeded federal guidelines set to prevent illness from contact with water (a geometric average of 126 CFU/100 ml).

***E. coli* Survival in Dog Waste:** We found nearly complete loss of *E. coli* in dog feces within 60 hrs of exposure to evaporation rates of 0.08 inches/day and within 15 hrs for 0.30 inches/day. Although temperature had a small effect on the rate of *E. coli* die-off, water content had the biggest effect on how quickly *E. coli* disappeared from feces.

WHAT THE RESULTS MEAN

The results suggest that under the right circumstances E. coli in dog wastes may die quickly as moisture evaporates from feces, with complete die-off even before feces are completely desiccated. This helps to explain why we found no link between *E. coli* in water samples and the accumulations of dog wastes in the study area drained by Burke Creek.

In order for water to be contaminated, bacteria must enter the water. This can happen in a variety of ways, including direct introduction (by feces on bicycle tires or shoes), or indirect introduction by water or wind. It is possible that wastes in the study area were concentrated in areas where wind and water could move feces into Burke Creek. With regards to water, soils at the site were sandy and, unless frozen, very unlikely to have water running off them. In this case, areas where large amounts of feces accumulated may have exposed feces to high evaporation rates, which could quickly kill *E. coli* under the right circumstances.

The studies have several limitations that are important to understand. First, the survival studies took place under carefully controlled conditions in a laboratory. This was necessary to be sure that death of *E. coli* could be linked with evaporation rates. Second, the samples used in the study were smaller than an average dog feces. This means that the effects of evaporation on *E. coli* survival were likely to have been exaggerated. Third, the experiments considered only one strain of *E. coli*. Although *E. coli* is considered an indicator of contamination with feces, it is not clear that it is like all disease-causing microorganisms. In fact, some microorganisms such as *Cryptosporidium* and *Giardia* survive environmental stresses at much more extreme levels and for longer durations than those that were used for these experiments.

The results do not mean that dog wastes cannot contaminate water. Feces that contain disease-causing organisms and enter water supplies before these can be killed by desiccation or other stresses could pose a threat to people who use water downstream for swimming or wading.

STRATEGIES FOR REDUCING THE RISK OF CONTAMINATION WITH DISEASE CAUSING MICROORGANISMS

The risk of contamination changes with and could be high when evaporation rates are low and the potential for runoff from snowmelt or rainfall is high, for example during Fall and Spring months. The risk could be reduced significantly, using several strategies either singly or in combination.

First, waste accumulates in specific areas, for example at trail junctions or near trail heads. These areas are ideal places to install bag dispensing stations and litter bins.

Second, it is possible to manipulate where wastes accumulate in certain areas. For example, setting a pole surrounded by a light coating of sand on the soil encourages dogs to defecate near the pole, prompted by marking behavior (see *Animal Waste Collection* under "Additional Resources"). If sited away from streams and rills on the landscape, and accompanied by bag dispensing stations and waste collection bins, such sites could ensure that waste accumulates away from water bodies and is removed. Also, dogs prefer to defecate in areas where grass is longer (about 4") and not mowed frequently. Maintaining a toilet area away from streams and paved surfaces and providing owners with the means to collect and remove wastes can substantially reduce the potential for contamination.

Third, a public awareness campaign can encourage dog owners to collect and properly dispose of wastes. This could involve working closely with land management agencies (local municipal and county parks departments). One of the most important parts of starting a campaign is to be sure that resources are available to sustain the program, including maintaining bagging stations and disposing of wastes.

For further information please contact:

Additional Resources:

Public Open Space and Dogs, 1995. Harlock Jackson Pty Ltd Ch. 7: Specific Guidelines for the selection, design and management of individual parks. http://www.petnet.com.au/openspace/frontis.html (last accessed 4/2008)

Pollution Prevention: Animal Waste Collection www.stormwatercenter.net/Pollution_Prevention_Factsheets/AnimalWasteCollection.htm (last accessed 4/2008)

AGRICULTURAL EXPERIMENT STATION

This publication produced with support from:

The Nevada Agricultural Experiment Station at the University of Nevada and a Regional Water Quality Coordination Grant provided by the U.S. Department of Agriculture's Cooperative State Research, Education and Extension Service.