

Companion Canine Nutrient Contributions to Kentucky's Urban Environment

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Eutrophication is a significant environmental issue affecting creeks, streams, and lakes, and excess nutrients, particularly nitrogen (N) and phosphorus (P), play a crucial role in its development. Microbial growth due to excess nutrients in the environment can be devastating to aquatic life and water resources. When eutrophication occurs, excess nutrients in fresh water can cause algal blooms, some of which are toxic to humans and pets. As these algae die and decompose, oxygen is consumed in the process, creating “dead zones” where oxygen levels are too low to support aquatic life. Fish kills and other negative impacts on aquatic ecosystems can result from this lack of oxygen. In urban areas, there are two major sources of excess nutrients: fertilizers (garden, landscape, and lawn) and dog excrement. In this publication, the critical issues of excess nutrient pollution in urban areas will be evaluated with a specific focus on the P contributions stemming from dog excrement. Understanding and addressing this source of contamination is essential in the collective efforts to preserve the health of urban water ecosystems.

Plant Nutrient Needs

In urban areas, the predominant plants grown include turfgrass, ornamental plants, and garden plants (both flowering and vegetables). A widespread practice throughout the United States involves the assumption that the soil and atmosphere naturally provide plants with adequate amounts of almost all the essential nutrients, except for N, P, and potassium (K). As a result, there are several

consumer grades of bagged fertilizer products available with various ratios of N, P and K. These fertilizers are readily available at retail outlets, including specialty stores as well as big box stores.

Nutrient Levels in Kentucky Soils

In Kentucky, almost all urban soils have adequate to excessive amounts of P and K. Having too much K in soils is not an environmental problem as K adheres well to soils and is not a pollutant of concern. Soil concentrations of N are ephemeral, fluctuating due to plant uptake, fixation through microbiological biological processes, leaching, or surface runoff. Nitrogen is usually applied according to anticipated plant needs at specific times of the year—spring and early summer for most herbaceous ornamental and vegetable plants and fall for cool-season turfgrass, trees, and shrubs. Timely and conservative applications of N can reduce N losses and help avoid environmental impacts. However, excessive amounts of soil P can be a problem for water quality in nearby streams. Stormwater runoff carries excess nutrients to waterbodies, especially P and N when applied incorrectly. These excess nutrients provide the building blocks for cyanobacteria which can result in a hazardous algal bloom and be harmful to aquatic and terrestrial life, including humans and pets.

A 25-year analysis of soil test P levels in Kentucky demonstrates that urban soils have an exceedingly high amount of P and the trend is increasing over time (Figure 1), relative to agricultural soils. This is likely due to homeowners managing their landscapes

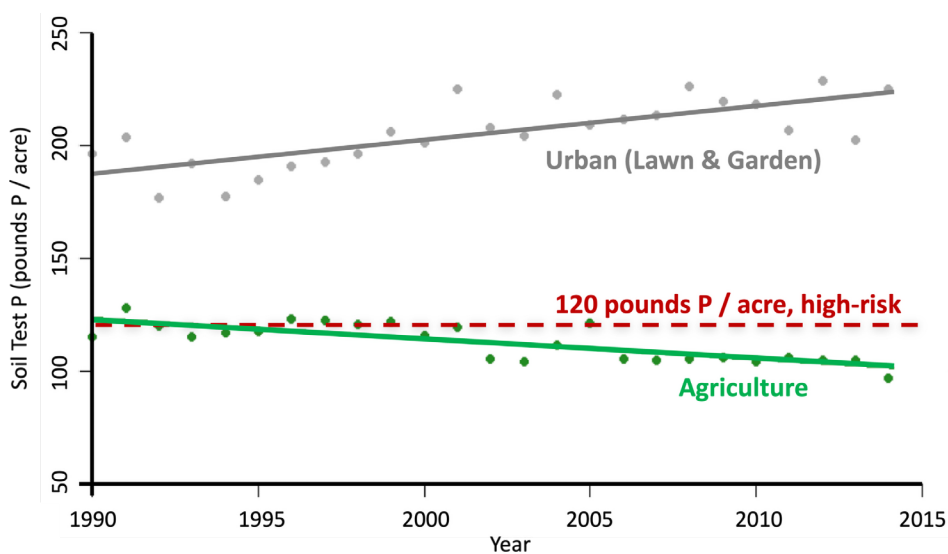


Figure 1. Average soil test phosphorus (P) levels from urban soils and agricultural soils across Kentucky. On average, urban soil test P levels are well above the high-risk water quality level of 120 pounds P/acre and increasing with time, while average annual agricultural soil test P values have been decreasing. The high-risk threshold of 120 pounds P/acre is the soil P concentration at which the risk of soil P losses via runoff and leaching becomes likely.

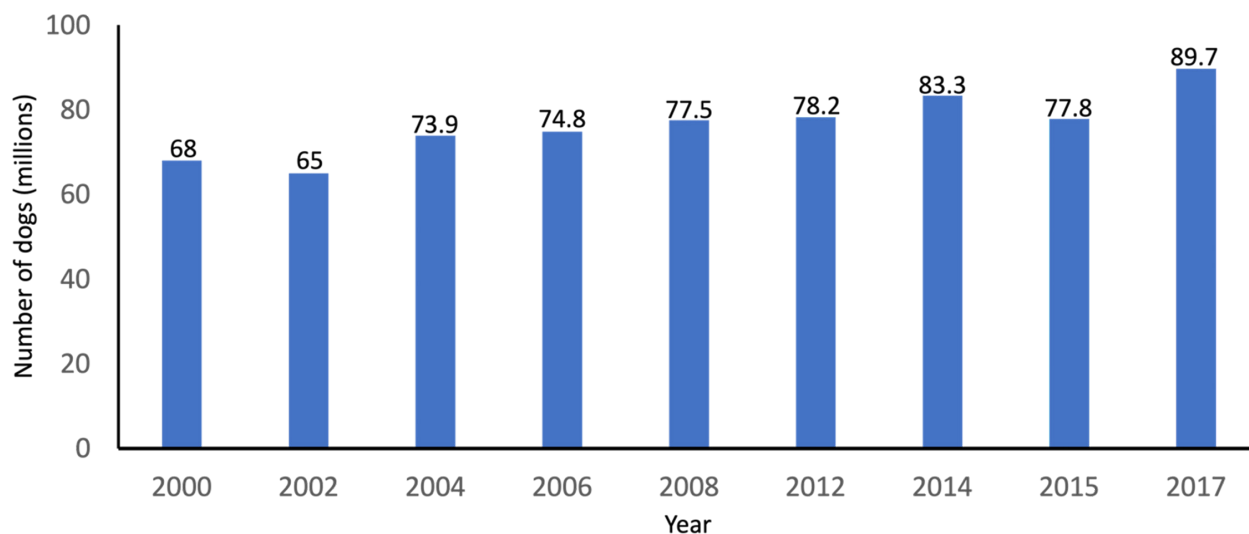


Figure 2. American Veterinary Medical Association estimates of the number of dogs as pets in the United States from 2000 to 2017. In December 2020, the American Pet Products Association found that during the Covid-19 pandemic 11.4 million households got a new pet.

without performing a soil test, which is the only way to determine if and how much P a planted area needs. The lack of soil testing has led to a prevalent practice of overapplying P, posing a significant risk to water quality.

Companion Canines

Dogs are becoming more and more popular as pets (Figure 2). According to the American Veterinary Medical Association, 56.8% of United States households have pets, with the most popular pet being a dog. Within Kentucky, 46.9% of households own dogs, with an average of 1.9 dogs per dog-owning household.

Nutrient Content of Canine Excrement

As with all biological waste products, there is a significant concentration of nutrients in dog excrement. At a P content of 3.1% and an N content at 3.9%, dog excrement has a higher nutrient concentration than almost all agriculturally significant manure products that are utilized in agricultural production systems (Table 1).

According to the Environmental Protection Agency, a typical dog excretes 0.75 pound (moist weight) of excrement per day, resulting in 2.5 pounds of P being introduced into the environment per year. If every other house in Kentucky has two dogs, that would result in about 4 million pounds of P being added to Kentucky’s watersheds each year. Since dogs live with people and most people live in urban areas where P levels are already high, that means the majority of dog excrement P is being added to urban watershed soils.

What Can You Do?

Numerous studies have determined that, in public, dog owners pick up their dog’s excrement about 60% of the time. However, it is likely that this percentage of excrement collection is much smaller in backyards. Dog excrement usually is deposited daily on the backyard lawn morning and evening, then the excrement breaks down, releasing the nutrient elements—including P and N—it contains. Nitrogen will be readily absorbed by organisms including landscape plants, volatilized into the atmosphere, or

Table 1. Nitrogen and phosphorus content of dog excrement relative to selected animal manures commonly used in soil nutrient amendments in agriculture.

Manure Soil Amendments	% Nitrogen	% Phosphorus
Dog excrement	4	3
Poultry litter	2-4	1-3
Beef feedlot	2-3	1-1.5
Dairy	1-2	0.5-1.5
Urban yard waste	1-1.5	0.2-0.5
Crop residue	1.5-2.5	0.2-0.5
Milorganite (sewage)	5	1-2
Horse (bedding)	1	0.5
Rabbit	2	1

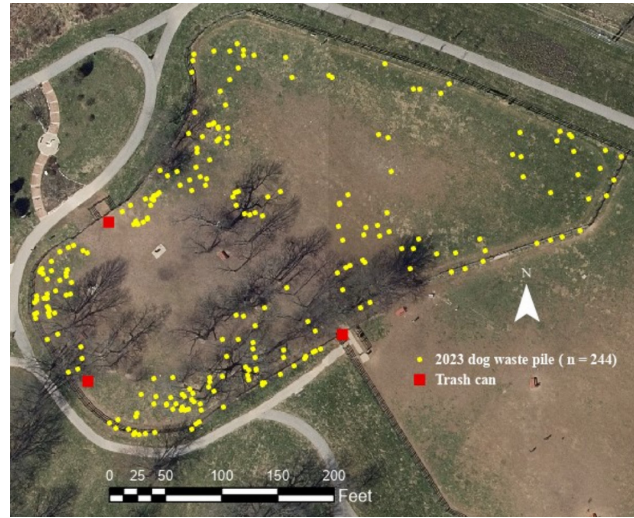
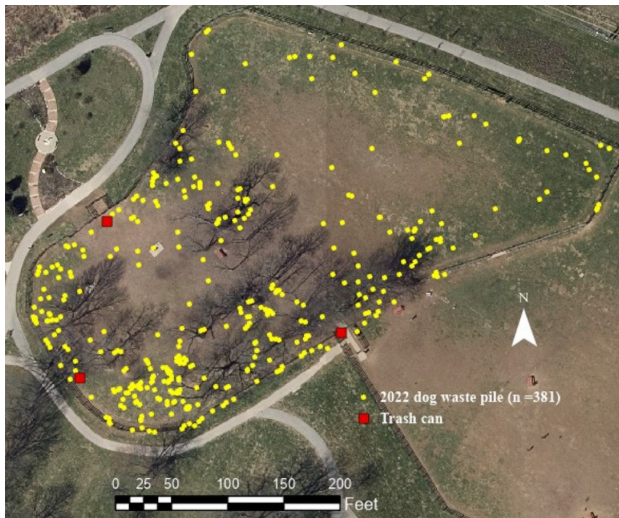


Figure 3. Location of dog-excrement piles (yellow circles) and trash bins (red squares) on the ground on April 21, 2022 (left) and April 22, 2023 (right), Wellington Dog Park, Lexington, KY.

lost to leaching or runoff water. Most of the P will be adsorbed onto soil particle surfaces, but desorbed soluble P and soil particles with adsorbed P can get carried by runoff water moving into storm sewers during the next rainfall event. If soil P levels are high, above 120 pounds P/acre, soluble P can leach from the soil into groundwater networks. Urban dog owners should diligently pick up after canine companions on a walk, at the dog park, or in other public spaces. Most dog owners do, but many do not (Figure 3). Dog owners should also pick up after their dogs at home.

Disposal of Canine Excrement

The best thing dog owners can do is to pick up dog excrement in a timely manner and dispose of it properly. Proper disposal has two options:

1. Bagging and landfill: Dispose of bagged excrement in regular solid waste collection for landfill disposal.
2. Toilet flushing: Flush it down the household toilet (just the excrement, not a bag). This is only a viable option if your home is connected to a sanitary sewer system: *Do not put dog excrement into a septic system.*

Under no circumstances should homeowners attempt to compost dog excrement, and it should not be added to yard-waste recycling bins. To kill pathogens in pet excrement, compost piles must consistently be heated to temperatures more than 140 degrees for three days. Home composting processes cannot consistently heat compost to a temperature sufficient to eliminate pathogens and many commercial composting facilities may not eliminate all the pathogens. Additionally, burying dog excrement is not recommended either as this will not kill pathogens.

Some pilot projects have been initiated to find an alternate use for dog excrement. Most have focused on conversion of dog excrement to energy via a biodigester and utilization of the residuals as fertilizer. However, these pilot projects were limited in scope and largely have been unsuccessful for expansion up to a scale that would be adopted by a town or community.

Remember:

- Dog excrement contains pathogens and nutrients that are harmful to the environment and humans.
- Only 60% of people pick up after their dog in public. Even fewer do so at home.
- Pick up after your pet in public and at home to reduce nutrient loading to the environment.
- Send dog excrement to the landfill. You can flush dog excrement down the toilet *only* if you are on a sanitary sewer system.
- Do not compost or bury dog excrement as this will not kill pathogens.

By adhering to these guidelines, dog owners can actively contribute to minimizing the environmental impact associated with dog excrement and promote responsible pet ownership.

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